Tampere University

SAMULI KANGASLAMPI

Mechanisms of change in psychological treatment of posttraumatic stress symptoms among children and adolescents

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Tampere
July 16, 2019

Samuli Kangaslampi

ABSTRACT

Background: For many who experience them, repeated traumatic events lead to chronic posttraumatic stress symptoms (PTSS). Forms of trauma-focused cognitive-behavioral therapy are able to treat PTSS among adults as well as children and adolescents. However, not all those suffering from PTSS benefit from such treatment. Availability and utilization of treatment are also significant problems both globally and in Finland. For further developing, better targeting, and effective implementation of treatments, it would be important to understand the underlying mechanisms of change by which they are able to reduce PTSS.

Theories of posttraumatic stress disorder suggest two psychological mechanisms of change in particular to be key to treating PTSS: improvements in overly negative posttraumatic cognitions and the integration, contextualization, or normalization of traumatic memories. This dissertation examined the role of changes in negative posttraumatic cognitions and traumatic memories in two interventions aimed at children and adolescents traumatized by war or violence and evaluated the overall level of evidence available for different mechanisms of change in the treatment of PTSS. Additionally, with a randomized controlled trial, we studied the feasibility, acceptability, and effectiveness of narrative exposure therapy in the treatment of multiply traumatized children and adolescents within the Finnish healthcare system.

Method: The empirical research in this dissertation is based on two sets of data. The first data set, collected from Gaza, Palestine, concerned 482 school-aged children randomized to take part in either a four-week group intervention, Teaching Recovery Techniques, or a waitlist. Using self-report measures, we collected information on the children's experiences of war trauma, mental health, and posttraumatic cognitions before the intervention, during it, after it, and as follow-up six months later. The second data set concerned 50 children and adolescents 9–17 years of age living in Finland, who entered treatment at different healthcare units due to significant PTSS because of exposure to war or violence in the family. Half were randomized to receive narrative exposure therapy, while the rest received treatment as usual. Using mainly self-report measures, we collected information on their mental health, posttraumatic cognitions, and traumatic memories before and after treatment. In addition, the dissertation contains a systematic review collecting

all available empirical evidence from randomized, controlled trials on the role of different mechanisms of change in psychological treatment of PTSS.

Results: The Teaching Recovery Techniques group intervention was not able to change the posttraumatic cognitions of Gazan children significantly. Such changes did not act as its mechanism of change. This may also explain its limited effects on PTSS. High levels of PTSS and depressive symptoms predicted particularly severe, stable posttraumatic cognitions.

Clinicians were able to implement narrative exposure therapy successfully in the treatment of multiply traumatized children and adolescents at different units within the Finnish healthcare system. Narrative exposure therapy was at least as effective in treating PTSS as treatment as usual. Some results suggested it was slightly more effective. Positive changes in posttraumatic cognitions and traumatic memories were both associated with amelioration of PTSS. However, we found no evidence of such changes acting as mechanisms of change specific to narrative exposure therapy. We found no evidence of overall significant changes in posttraumatic cognitions during treatment. Overall changes in traumatic memories were relatively small.

The systematic review found evidence for the importance of changes in negative posttraumatic cognitions in several forms of treatment. Negative cognitions related to the self may be especially relevant. As of yet, there is next to no empirical evidence on changes in traumatic memories as a mechanism of change. Some preliminary findings suggest mindfulness-based interventions can reduce PTSS by increasing levels of dispositional mindfulness. The evidence for other specific mechanisms of change is still very limited and mixed.

Conclusions: Exposure-based treatment is suitable for treatment of multiply traumatized children and adolescents within the Finnish healthcare system and does reduce PTSS. Changing the negative posttraumatic cognitions of children and adolescents traumatized by war and violence may be especially challenging. Still, it is a probable pathway to treating PTSS among them, as well. The effectiveness of group psychosocial interventions in reducing PTSS may be limited by their inability to affect posttraumatic cognitions. Changes in traumatic memories may be linked to recovery from PTSS, but evidence for such a link is still very limited.

TIIVISTELMÄ

Tausta: Toistuvat traumaattiset kokemukset johtavat merkittävällä osalla niitä kokevista ihmisistä pitkäkestoisiin traumaperäisen stressihäiriön (posttraumatic stress disorder, PTSD) oireisiin. Traumaan keskittyvillä kognitiivisen käyttäytymisterapian muodoilla voidaan hoitaa sekä aikuisten että lasten ja nuorten PTSD-oireita. Kaikki eivät kuitenkaan hyödy nykyisistä hoitomuodoista. Hoitoon ohjautuminen ja toimivaksi osoitetun hoidon saatavuus ovat myös merkittäviä ongelmia sekä globaalisti että Suomessa. Hoitojen kehittämisen, kohdentamisen ja tehokkaan toteuttamisen kannalta olisi tärkeää ymmärtää, millaisten muutosmekanismien kautta ne johtavat PTSD-oireiden vähenemiseen.

PTSD-teoriat ennustavat erityisesti kahden psykologisen muutosmekanismin olevan keskeisiä oireiden hoitamiselle: traumanjälkeisten ylinegatiivisten ajatusten ja arvioiden korjaantuminen sekä traumamuiston integroituminen, eheytyminen tai normalisoituminen. Tämä väitöstutkimus arvioi traumanjälkeisten ajatusten ja traumamuiston muuttumisen merkitystä kahdessa sodan tai väkivallan traumatisoimille lapsille ja nuorille suunnatussa hoitomuodossa, sekä selvitti, mistä muutosmekanismeista on ylipäätään saatavilla tieteellistä näyttöä PTSD-oireiden hoidossa. Samalla tutkimme satunnaistetulla kokeella narratiivisen altistusterapian sopivuutta ja vaikuttavuutta moninkertaisesti traumatisoituneiden lasten ja nuorten hoidossa suomalaisen terveydenhuoltojärjestelmän osana.

Menetelmät: Väitöstutkimuksen empiirinen osuus perustuu kahteen aineistoon. Ensimmäinen Gazasta, Palestiinasta kerätty aineisto käsitti 482 alakouluikäistä lasta, jotka satunnaistettiin joko osallistumaan neljän viikon pituiseen Teaching Recovery Techniques –ryhmäinterventioon tai odotuslistaan. Itsearviomittarein kerättiin tietoa lasten sotatraumakokemuksista, mielenterveysoireista sekä traumanjälkeisistä ajatuksista ennen interventiota, sen aikana, sen jälkeen ja kuuden kuukauden seurannassa. Toinen aineisto käsitti 50 Suomessa asuvaa 9–17-vuotiasta sodan tai perheväkivallan traumatisoimaa lasta ja nuorta, jotka tulivat huomattavien traumaperäisten stressioireiden vuoksi hoidon piiriin terveydenhuollon yksiköissä eri puolilla Suomea. Heistä puolet satunnaistettiin saamaan narratiivista altistusterapiaa ja puolet kunkin yksikön tavanomaista hoitoa. Pääasiassa itsearviomittarein kerättiin tietoa osallistujien mielenterveydestä, traumanjälkeisistä ajatuksista ja

traumamuistoista ennen hoitoa ja sen jälkeen. Lisäksi väitöstutkimukseen kuuluu systemaattinen katsaus, johon keräsimme kaiken satunnaistetuista, kontrolloiduista kokeista saatavilla olleen tieteellisen näytön eri muutosmekanismien roolista PTSD-oireiden psykologisessa hoidossa.

Tulokset: Teaching Recovery Techniques –interventio ei onnistunut merkittävästi vaikuttamaan gazalaisten lasten traumanjälkeisiin ajatuksiin odotuslistaan verrattuna, eivätkä tällaiset muutokset toimineet sen erityisenä muutosmekanismina. Tämä voi selittää myös sen rajoittuneita vaikutuksia traumaperäisiin stressioireisiin. Voimakkaat traumaperäiset stressioireet ja masennusoireet ennustivat erityisen pysyviä, ongelmallisia traumanjälkeisiä ajatuksia.

Narratiivista altistusterapiaa voitiin onnistuneesti ja vaikuttavasti toteuttaa moninkertaisesti traumatisoituneilla lapsilla ja nuorilla suomalaisen terveydenhuollon eri yksiköissä. Narratiivinen altistusterapia oli vähintään yhtä vaikuttavaa traumaperäisten stressioireiden hoidossa kuin nykyinen tavanomainen hoito. Osa tuloksista viittasi myös sen parempaan vaikuttavuuteen. Positiiviset muutokset traumanjälkeisissä ajatuksissa ja traumamuistoissa olivat yhteydessä traumaperäisten stressioireiden helpottumiseen, mutta näyttöä ei saatu siitä, että nämä muutokset olisivat toimineet narratiivisen altistusterapian erityisinä muutosmekanismeina. Traumanjälkeisissä ajatuksissa ei havaittu merkittävää muutosta hoidon aikana. Muutokset traumamuistoissa olivat kohtalaisen lieviä.

Kirjallisuuskatsaus osoitti, että traumanjälkeisten ajatusten korjaantumisen merkityksestä on näyttöä useissa hoitomuodoissa. Erityisen tärkeitä saattavat olla itseen liittyvät ylinegatiiviset arviot. Traumamuistojen korjaantumisen merkityksestä ei ole vielä juuri lainkaan empiiristä näyttöä. Muutamien viitteiden mukaan mindfulness-pohjaisilla interventioilla voitaisiin vaikuttaa traumaperäisiin stressioireisiin tietoista läsnäoloa lisäämällä. Muiden vaikutusmekanismien osalta näyttö on hyvin vähäistä ja osin ristiriitaista.

Johtopäätökset: Altistukseen perustuva hoito soveltuu myös suomalaisessa terveydenhuoltojärjestelmässä moninkertaisesti traumatisoituneiden lasten ja nuorten hoitoon ja vähentää traumaperäisiä stressioireita. Traumanjälkeisten ajatusten muuttaminen lienee erityisen haastavaa sodan ja väkivallan traumatisoimilla lapsilla ja nuorilla. Se on kuitenkin todennäköinen reitti traumaoireiden hoitamiseen myös heillä. Ryhmäpohjaisten interventioiden mahdollisuuksia parantaa lasten PTSD-oireita saattaa rajoittaa niiden kyvyttömyys vaikuttaa juuri traumanjälkeisiin ajatuksiin. Traumamuistojen laadun muuttumisella saattaa olla merkitystä PTSD-oireista palautumiselle, mutta yhteys on toistaiseksi epävarma.

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ABBREVIATIONS

ASD	acute stress disorder
C-rep	representation in contextual memory
CBT	cognitive-behavioral therapy
CPT	cognitive processing therapy
CPTSD	complex posttraumatic stress disorder
CPTCI	Children's Post-Traumatic Cognitions Inventory
CT-PTSD	cognitive therapy for PTSD
CRIES	Children's Revised Impact of Event Scale
ICD-10	International Classification of Diseases, 10th revision
ICD-11	International Classification of Diseases, 11th revision
DSM-III	Diagnostic and Statistical Manual of Mental Disorders, 3rd ed.
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders, 4th ed.
DSM-5	Diagnostic and Statistical Manual of Mental Disorders, 5th ed.
EMDR	eye-movement desensitization and reprocessing therapy
EPT	emotional processing theory
MI	multiple imputation
NET	narrative exposure therapy
PE	prolonged exposure
PE-A	prolonged exposure for adolescents
PTC	posttraumatic cognition
PTSD	posttraumatic stress disorder
PTSS	posttraumatic stress symptoms
RCT	randomized controlled trial
S-rep	representation in sensation-based memory
SAM	situationally accessible memory
TAU	treatment as usual
TF-CBT	trauma-focused cognitive-behavioral therapy
TMQQ	Trauma Memory Quality Questionnaire
TRT	Teaching Recovery Techniques intervention
VAM	verbally accessible memory

ORIGINAL PUBLICATIONS

I Kangaslampi, S., & Peltonen, K. (Accepted). Mechanisms of change in psychological interventions for posttraumatic stress symptoms: A systematic review with recommendations. *Current Psychology*.

II Kangaslampi, S., Punamäki, R.-L., Qouta, S., Diab, M., & Peltonen, K. (2016). Psychosocial group intervention among war-affected children: An analysis of changes in posttraumatic cognitions. *Journal of Traumatic Stress, 29*(6), 546–555. https://doi.org/10.1002/jts.22149

III Peltonen, K., & Kangaslampi, S. (2019). Treating children and adolescents with multiple traumas: A randomized clinical trial of narrative exposure therapy. *European Journal of Psychotraumatology, 10*(1), 1558708. https://doi.org/10.1080/20008198.2018.1558708

IV Kangaslampi, S., & Peltonen, K. (2019). Changes in traumatic memories and posttraumatic cognitions associate with PTSD symptom improvement in treatment of multiply traumatized children and adolescents. *Journal of Child and Adolescent Trauma*. Advance online publication. https://doi.org/10.1007/s40653-019-00255-3

1 INTRODUCTION

During our lifetimes, most of us will face an unexpected event threatening or horrific enough to have the potential to cause a deep psychological wound, a trauma. All of us who experience a traumatic event will need to come to terms with it in some way, adapting to what such an experience means for our understanding of the world, ourselves, and other people, and the consequences that result from it. For many, this involves significant distress and challenge to mental health. Due to a combination of numerous genetic, developmental, social, and psychological risk and protective factors, some of us will be more resilient in the face of trauma and experience even rapid natural recovery. Others are not so lucky and go on to develop long-lasting posttraumatic stress symptoms. This is especially likely for those who experience repeated, severe trauma such as the effects of war or violence within the family.

Healing, even from long-term, chronic posttraumatic stress symptoms, is fortunately possible. A range of psychological treatments focusing on the traumatic experience and thoughts, memories, and experiences related to it have been developed and can successfully treat posttraumatic stress symptoms of adults as well as children and adolescents (Cusack et al., 2016; Gillies et al., 2016).

Both globally and in Finland, many who suffer from posttraumatic stress symptoms either do not seek help or do not receive effective treatment (Koenen et al., 2017; Lewis et al., 2019; Mitra & Hodes, 2019). Much remains to be done in translating research findings into clinical practice and disseminating new, effective treatments, especially for children and adolescents, into usual care environments. Meanwhile, though many experience reduction in symptoms or become asymptomatic through trauma-focused treatment, a substantial share of those who begin treatment drop out (Imel, Laska, Jakupcak, & Simpson, 2013) or are still left with debilitating symptoms despite completing treatment (Gillies et al., 2016; Watts et al., 2013)

We urgently need to find ways to further refine and develop treatments and target them better. A key to these challenges may lie in understanding the pathways through which psychological treatments are able to affect posttraumatic stress symptoms,

that is, the mechanisms of change that treatments set in motion in clients that lead to symptom alleviation.

Research on mechanisms of change is emerging. However, our understanding of such mechanisms is still very limited among children and adolescents, and especially so among children and adolescents repeatedly affected by violence within the family or war. This dissertation aims to contribute to our understanding of mechanisms of change in the psychological treatment of posttraumatic stress symptoms and their role in the implementation of trauma-focused treatment in several ways.

First, in Study I, we carry out the first systematic review of all available evidence from randomized, controlled trials on different mechanisms of change involved in all types of psychological treatment for posttraumatic stress symptoms. Much of previous research on mechanisms of change has been marred by imprecise definitions and overlapping constructs in relation to change processes in psychological treatment, as well as inadequacies in methodology and reporting of results. By adopting a clear, unequivocal definition of mechanisms of change and separating them from in-session processes or active ingredients of therapy, we hope to bring some order to the field. Then, by reviewing the existing evidence on mechanisms of change in all types of psychological treatments, instead of just particular prominent cognitive-behavioral approaches, we hope to bring to light potentially important mechanisms overlooked so far. Simultaneously, this systematic approach allows us to note mechanisms of change that may be much emphasized in theorizing about PTSD or in clinical practice, but for which little solid empirical evidence actually exists. By providing a set of practical recommendations for future research on mechanisms of change based on our findings, we also hope to contribute to improved standards of research and reporting when studying this important area.

Second, in Study II, we examine the role of changes in negative posttraumatic cognitions in the effects of a group psychosocial intervention for school-aged children affected by war in Gaza, Palestine. Based on data from a cluster-randomized, controlled trial, we analyze whether the group-based Teaching Recovery Techniques intervention (TRT; Smith, Dyregrov, & Yule, 2000) was able to improve the children's negative posttraumatic cognitions, as compared with a waitlist. We then assess whether changes in these cognitions acted as a mechanism of change responsible for some of the intervention's long-term effects on posttraumatic stress symptoms. Finally, we identify different trajectories of posttraumatic cognitions among children participating in the intervention, as well as demographic and mental health factors that might affect these trajectories.

Third, in Study III, we study the effectiveness and associated mechanisms of change of a modern evidence-based trauma-focused cognitive-behavioral treatment, narrative exposure therapy (NET; Schauer, Neuner, & Elbert, 2011), among children and adolescents multiply traumatized by exposure to war and refugeedom or violence within the family, in usual care environments in Finland. We determine whether clinicians who would in any case treat these children and adolescents are able to implement NET feasibly and safely at different healthcare units. In a pragmatic, randomized, controlled trial, we compare the effectiveness of NET to treatment as usual (TAU) in reducing posttraumatic stress symptoms and other mental health problems and improving resilience. We expect both treatments to be effective in reducing posttraumatic stress symptoms, but that NET as an evidence-based treatment will demonstrate some added effectiveness compared with TAU.

Further, in Study IV, we examine the role of two potential mechanisms of change, changes in negative posttraumatic cognitions and improvements in problematic qualities of traumatic memories in the effects of NET and TAU. We again expect both treatments to lead to changes in these mechanisms, but that NET may have a stronger effect on them, and that changes in the mechanisms will account for some of the added effectiveness of NET in treating posttraumatic stress symptoms.

This research has direct clinical significance. Analyzing the effects of TRT on negative posttraumatic cognitions may help explain the varied levels of success implementations of similar group psychosocial interventions have had in different contexts globally and help guide selection of appropriate, effective interventions especially in challenging, post-conflict contexts. Within the research project on NET, we have trained a large number of clinicians in this evidence-based treatment and NET has entered everyday clinical use at different treatment units across Finland. I hope that our analyses on the suitability of NET for use in usual care conditions and its acceptability, safety, and effectiveness in treating multiply traumatized children and adolescents can also help convince clinicians more widely to implement evidence-based, trauma-focused treatment in this population of patients. The empirical research on NET and the comprehensive review of earlier evidence in this dissertation contribute to a more comprehensive understanding of which mechanisms of change are important to treating posttraumatic stress symptoms by psychological methods. Findings on mechanisms of change can and to some extent already have translated into enriched, more evidence-based training on NET and treating posttraumatic stress symptoms more generally, with a particular focus on empirically supported mechanisms.

2 PSYCHOLOGICAL TRAUMA AND ITS CONSEQUENCES

Human life includes everyday struggles and exceptional trials, predictable drudgery as well as sudden changes and surprises, successes and failures, achievements and disappointments. All our experiences and life events shape and mold us, many of them by presenting us challenges to overcome and stress to bear. Even strong emotional reactions to the vicissitudes of our existence, both negative and positive, are a normative part of life.

Yet, some exceptional incidents stand out as terrifying or dangerous enough to overwhelm our usual range of responses and methods of coping and set in motion special responses reserved for situations of life-threatening seriousness. These traumatic moments, which may burn into our memories for years and even decades, require us to adjust our assessments of what is possible and likely to occur in the world, and what we ourselves and other people are truly like. For some, they also cause long-term distress and suffering in the form of mental health symptoms. Recovering from a single traumatic incident is difficult enough, but repeated exposure to horrors of this caliber is even more likely to lead to serious and chronic stress symptoms.

2.1 Traumatic events

Codifying the clinical understanding of the term that emerged since the 1970s, the *Diagnostic and Statistical Manual of Mental Disorders, 4th edition,* (DSM-IV; American Psychiatric Association [APA], 1994) defined traumatic experiences as

> direct personal experience of an event that involves actual or threatened death or serious injury, or other threat to one's physical integrity; or witnessing an event that involves death, injury, or a threat to the physical integrity of another person; or learning about unexpected or violent death, serious harm, or threat of death or injury experienced by a family member of other close associate (p. 424)

The later *DSM-5* (APA, 2013) added to this all types of actual or threatened sexual violence and indirect exposure to particularly aversive details of events involving death or injury even when they do not involve a close person, if such exposure is repeated or extreme. Some trauma experts have argued that other extremely upsetting events that involve threat to psychological integrity or utterly overwhelm the survivor's psychological resources should also be considered traumatic (e.g., Briere, 2004; Briere & Scott, 2006). The upcoming *International Classification of Diseases, 11th revision* (ICD-11; World Health Organization [WHO], 2018), accepts as events triggering posttraumatic stress any "exposure to an extremely threatening or horrific event or series of events" (§6B40).

Aside from their threatening or horrific nature, we may also distinguish traumatic experiences from other experiences, even emotionally highly negative ones, by the fact that they set in motion a special cascade of acute stress responses evolved in humans to increase the likelihood of survival in situations of direct risk to life, as presented in Figure 1. These responses were originally described as fight or flight (Cannon, 1915), i.e., as rapid preparation for either direct confrontation with the threat or escape away from it. A more complete understanding of the range of acute stress responses encompasses not just confrontation or escape, involving high sympathetic nervous system activation, but also initial freezing in attentive immobility as an orientation response and increasingly parasympathetically driven reactions of frightful tonic immobility, flagging, and, in extreme cases, vasovagal syncope or fainting (Bracha, 2004; Schauer & Elbert, 2010; Vila et al., 2007).

Among others, Schauer and Elbert (2010) have argued that we should limit the term *trauma* to cases where an experience has indeed led to such responses, as it is because of this physiological cascade that traumatic events may have long-term negative effects. Some diagnostic systems, too, have acknowledged that the traumatic nature of an event depends crucially on the survivor's reaction to that event. In the *DSM-IV*, diagnostic criterion A2 for posttraumatic stress disorder stated that "The person's response to the event must involve intense fear, helplessness, or horror … In children, this may be expressed instead by disorganized or agitated behavior" (APA, 1994, p. 428). Somewhat controversially, the latest edition of the manual, the *DSM-5* (APA, 2013) removed this criterion, and such a requirement is not present in the *ICD-11*, either (WHO, 2018).

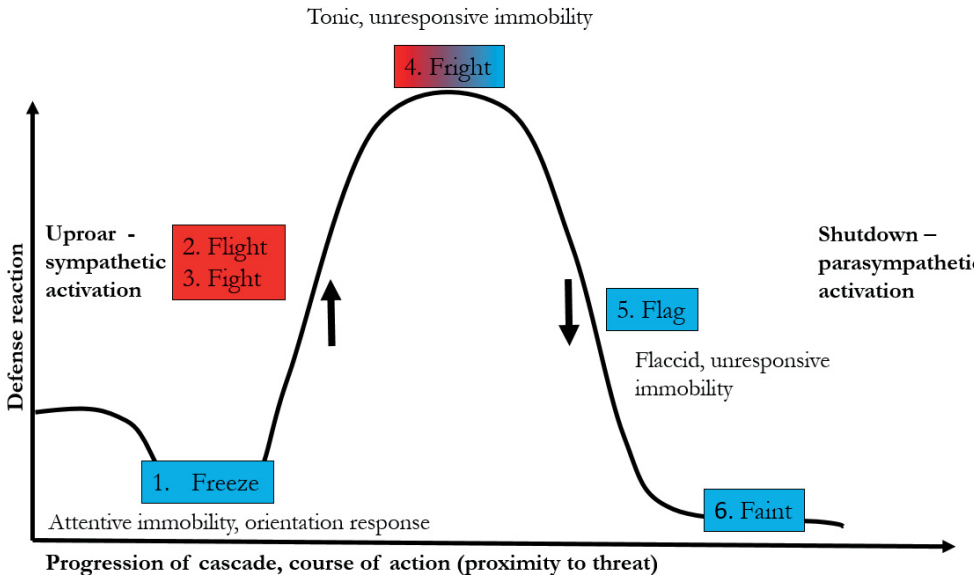

Figure 1. Progression of defense cascade in the face of trauma. Sympathetic arousal responses, presented in red, reach their maximum at the fright stage. The onset of dissociative shut down responses, in blue, then supersede uproar responses. Based on model presented in Schauer & Elbert (2010) and Schauer, Neuner, & Elbert (2011).

In this dissertation, I take a relatively liberal view of psychological trauma, accepting threats to psychological integrity or other extremely upsetting emotional events as potentially traumatic even when no risk to physical integrity or life exists. Still, our empirical research concerns repeated exposure to horrific events related to war and violence. As such, I wish to set clearly apart from often lax lay uses of the word *trauma* these traumatic events as exceptional, terrible occasions provoking intense stress that differ qualitatively from other negative emotional events or challenges in life.

Though traumatic experiences are usually rare occasions for any individual, the experience of at least one such event in one's lifetime is not uncommon. Depending on exact criteria and country, estimates of the share of the general adult population who have experienced at least one traumatic event in their lifetime range from 29% in Bulgaria (Benjet et al., 2016) and 40% in Chile (Pérez Benítez et al., 2009) to 85% in Ukraine (Benjet et al., 2016) and 70–90% in the US (Breslau & Kessler, 2001; Elliott, 1997; Kilpatrick et al., 2013). Based on the World Mental Health survey, Benjet et al. (2016) reported that a global average of 70% of adults have experienced a traumatic event and 30% four or more events.

Unfortunately, children and adolescents also face trauma rather frequently. In the US, two thirds of adolescents may experience at least one traumatic event by age 17, and around one third two or more (Copeland, Keeler, Angold, & Costello, 2007; McLaughlin et al., 2013). Lower rates have been reported in Europe. Lewis et al. (2019) found 31% of UK adolescents to have experienced a traumatic event by the age of 18, while Perkonigg, Kessler, Storz, and Wittchen (2000) reported a lifetime rate of 21% for traumatic exposure among German 14–24-year-olds.

2.2 Posttraumatic stress symptoms

In the immediate aftermath of trauma, reactions such as fear and anxiety, heightened arousal and startling, intrusive memories of the trauma, and problems sleeping are common and normative. However, as time passes, most survivors of a single traumatic event, whether adults or children, recover and such reactions subside (Hiller et al., 2016; Lai, Lewis, Livings, La Greca, & Esnard, 2017; Santiago et al., 2013). Not all who face trauma experience long-term trauma-related mental health symptoms. But a significant minority do.

Although a number of other negative mental health outcomes may result from exposure to trauma, as discussed below in Section 2.5, this dissertation focuses on distinctive posttraumatic stress symptoms (PTSS) that develop after exposure to a traumatic event. Among adults such symptoms most typically include re-experiencing the event in the form of nightmares, flashbacks, or intrusive memories, hyperarousal in the form of hypervigilance, exaggerated startle response or sleep problems, as well as avoidance of internal or external reminders of the event (APA, 2013; Brewin, Lanius, Novac, Schnyder, & Galea, 2009). Developmental stage affects symptom manifestation among children, but quite similar symptoms are observed in school-aged children and adolescents, as well (Anthony, Lonigan, & Hecht, 1999; Meiser-Stedman, 2002; Salmon & Bryant, 2002).

When PTSS continue beyond the acute phase for at least one month post-trauma and cause significant distress, diagnostic systems suggest a diagnosis of posttraumatic stress disorder (PTSD; APA, 2013; WHO, 2018). In a systematic review of longitudinal studies on adults directly exposed to a traumatic event, Santiago et al. (2013) found the prevalence of PTSD to be 25% one month after trauma and 17% one year after trauma. A large meta-analysis by Alisic et al. (2014) found that 16% of children and adolescents exposed to a traumatic event went on to develop PTSD. This means that while most individuals may face a traumatic event during their

lifetime, estimates for lifetime prevalence of PTSD among the general population globally generally range between 4–8% for adults (Kessler et al., 2005; Kilpatrick et al., 2013; Koenen et al., 2017; Pérez Benítez et al., 2009), although rates as low as 0.3% have been reported in China (Xi et al., 2017). Long-term outcomes vary, but more than half of cases of diagnosable PTSD may persist for over a year, and a substantial minority for even decades after the traumatic event (Morina, Wicherts, Lobbrecht, & Priebe, 2014; Rosellini et al., 2018).

Different types of trauma can produce relatively similar symptoms, which is why it makes sense to speak of PTSD as a general consequence of trauma instead of separate syndromes such as *rape trauma syndrome* (Burgess & Holström, 1974) or *war neurosis*. Still, the type of trauma experienced does matter at least for severity of PTSS. Alisic et al. (2014) found a rate of PTSD of around 10% for children and adolescents exposed to non-interpersonal trauma, such as accidents and natural disasters, and 25% for interpersonal trauma, such as violence and abuse. Similarly, Santiago et al. (2013) found prevalence of PTSD to be 23% one year post-trauma for adult survivors of intentional injury or trauma and 15% for those with non-intentional injury or trauma. Notably, the prevalence of PTSD also tended to increase from one month post-trauma to one year after it for those with intentional trauma, whereas the opposite was true for those with non-intentional trauma, suggesting not just differing prevalence but trajectories, too. Especially in terms of long-term outcomes, there is something worse about traumatic events that involve deliberate infliction of harm or pain by another human being, as compared with natural disasters or accidents with no perpetrator (see also Benjet et al., 2016, for global evidence).

2.3 Protective factors and predictors for developing PTSD

With repeated exposure to trauma, the probability of developing PTSD grows with increasing number of exposures and different types of traumatic events experienced, also termed *trauma load* (Kolassa, Ertl, Kolassa, Onyut, & Elbert, 2010; McLaughlin et al., 2013; Neugebauer et al., 2009; Neuner et al., 2004; Wilker et al., 2015). To some extent, a dose-effect relationship exists between trauma exposure and PTSS.

There are, however, a number of other factors that predict higher probability of developing PTSD. First, certain types of reactions during the trauma, such as peritraumatic dissociation (Hetzel & McCanne, 2005; Meiser-Stedman et al., 2019; Murray, Ehlers & Mayou, 2002; Peltonen, Kangaslampi, Saranpää, Qouta, & Punamäki, 2017) and tonic immobility (Fiszman et al., 2008; Heidt, Marx, & Forsyth,

2005), as well as proximity to danger and perceived direct life threat during the trauma (Ahmad et al., 2010; Furr, Comer, Edmunds, & Kendall, 2010; Meiser-Stedman et al., 2019) increase the probability of subsequent PTSD. Second, negative affectivity, neuroticism, low cognitive ability, and maladaptive and emotion-focused coping styles appear to be psychological risk factors for PTSD (DiGangi et al., 2013). In the aftermath of trauma, social factors such as lack of family and other social support (Koenen et al., 2017; Lai et al., 2017), low socio-economic status (Ahmad et al., 2010; Koenen et al., 2017) and stigmatization (Schneider et al., 2018; Ullman & Filippas, 2001) also predict a higher chance of PTSD. Genetic factors may further account for around 30–40% of variance in PTSS following traumatic exposure (Afifi, Asmundson, Taylor, & Lang, 2010; Cornelis, Nugent, Amstader, & Koenen, 2010; Enlow, Blood, & Egeland, 2013). For children and adolescents, developmental timing of the trauma may also be key. Infancy and early childhood on one hand and adolescence on the other have been considered particularly sensitive periods, although findings are somewhat mixed and trauma type may also play a role (Dunn, Nishimi, Powers, & Bradley, 2017; Gee & Casey, 2015). Finally, a consistent finding across age groups and cultures is that developing PTSD after exposure to traumatic events is more common for girls than boys (Alisic et al., 2014; McLaughlin et al., 2013; Neugebauer et al., 2009) and adult women than men (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995; Tolin & Foa, 2006).

Research has also identified numerous factors that can help trauma survivors recover and protect them from developing PTSD. Good emotion regulation capacity and strategies, positive affect, the use of active and adaptive coping methods, dispositional optimism, altruism, and a sense of mastery and control are psychological factors that contribute to resilience and decrease the probability of developing PTSD (Ahmad et al., 2010; Horn, Charney, & Feder, 2016; Feder et al., 2013). Particular social factors that have been found to protect child survivors of trauma include parental support and positive bonds with caregivers, social support from friends, peers, and schools, as well as shared values and beliefs that provide meaning (Horn et al., 2016; Sapienza & Masten, 2011; Werner, 2012).

2.4 Theories and models of PTSD

Several cognitive-emotional theories and models explain the development and maintenance of the rather distinctive phenomenology of PTSD. They also predict what is required to recover from PTSD symptoms. Figure 2 presents three such

models: the cognitive model of Ehlers and Clark (2000), emotional processing theory as applied to PTSD (Foa & Kozak, 1986; Foa, Huppert, & Cahill, 2006; Foa & Rothbaum, 1998), and dual representation theory (Brewin, Dalgleish, & Joseph, 1996; Brewin, Gregory, Lipton, & Burgess, 2010).

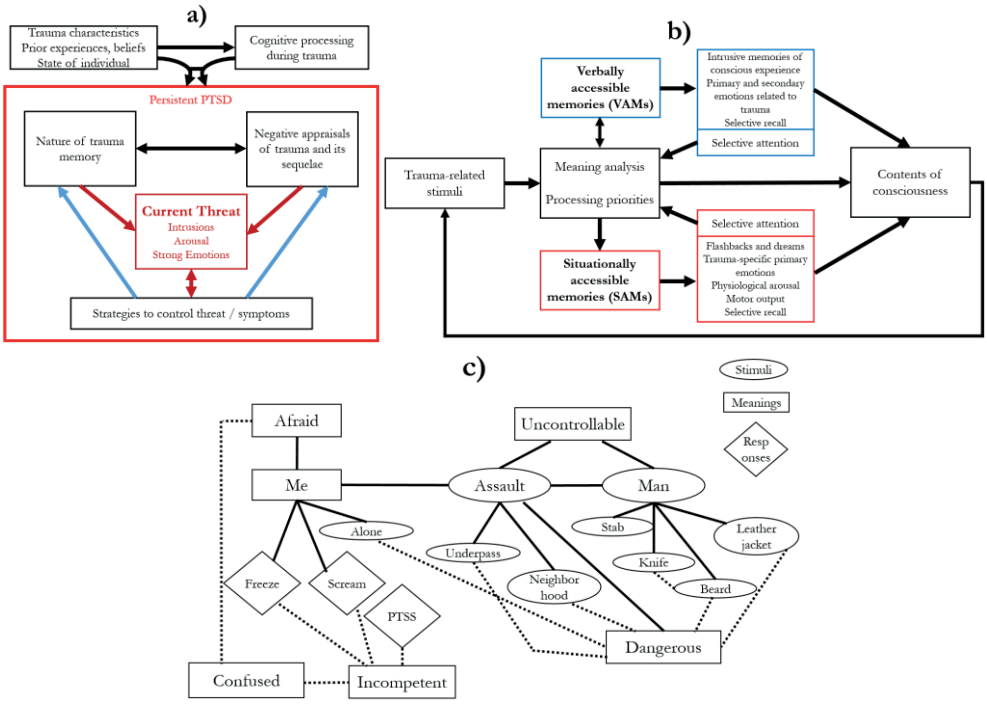

Figure 2. Three models of PTSD. a) Schematic presentation of the cognitive model of PTSD, based on Ehlers & Clark (2000). Black arrows indicate influence, red arrows indicate causation, blue arrows indicate preventive effect. b) Schematic presentation of cognitive processing of trauma-related stimuli according to dual representation theory, based on Brewin et al. (1996). c) Example of a fear structure related to assault according to emotional processing theory, based on Foa & Rothbaum (1998). Solid lines indicate realistic associations, dashed lines indicate erroneous associations.

2.4.1 Cognitive model

By their unpredictable, extreme, and uncommon nature, traumatic events challenge and can even shatter our basic assumptions and beliefs about the world and ourselves. Janoff-Bulman (1992) described three foundational assumptions most people share: the world is generally benevolent, the world has meaning, and our selves have worth. Or put differently, people are generally well-disposed towards us,

there exist rules and principles according to which we can predict which behaviors produce which kinds of outcomes, and we ourselves are good, well-meaning beings (Brewin, 2003). Whether realistic or not, such beliefs are necessary for people to function in the world, overcome difficulties, and plan for the future. Traumatic incidents are extreme counter-examples that contradict such beliefs or assumptions. The trauma survivor must attempt to integrate with his/her previously unquestioned core assumptions seemingly irreconcilable but salient evidence that terrible, unpredictable things can indeed occur in the world and, in the case of interpersonal trauma, that others can act towards us in dehumanizing, violent, and immoral ways. We may understand at least part of posttraumatic stress reactions as failure to integrate trauma-related information into one's current models or beliefs about the self, the world, and reality (Bolton & Hill, 1996; Brewin et al., 1996).

Several models of PTSD have placed major emphasis on how cognitive changes caused by trauma contribute to keeping up symptoms. Chief among these models is the cognitive model of Ehlers and Clark (2000). At the heart of this model is the claim that PTSD develops only when a trauma survivor processes the traumatic event in a way that results in a sense of serious, current threat. As presented in Figure 2a, Ehlers and Clark (2000) propose two main processes that lead to and keep up the sense of threat: 1) negative appraisals of the trauma and/or its sequelae, and 2) the nature of the traumatic memory and its links to other autobiographical memories.

Negative appraisals may relate to the traumatic event itself, leading to overgeneralizations and exaggerations of the probability of future harm and catastrophe and perceiving normal activities as highly dangerous (Ehlers & Clark, 2000). More personally, the trauma may be appraised as evidence of the trauma survivor themselves somehow attracting or being predisposed to disaster. Appraisals relating to one's own behavior during the traumatic event may include feeling that the trauma survivor deserved what happened to her/him or that she/he is totally incapable of dealing with stressful events. Appraisals of the results, consequences, and meaning of the trauma include failing to see initial posttraumatic reactions as normal but instead as indications of permanent change for the worse or threat to physical or mental well-being. This can both produce negative emotional symptoms, such as anxiety and anger, and lead to dysfunctional coping strategies such as thought suppression. The often well-intentioned reluctance of other people to talk about the trauma may be evaluated as evidence that they do not care or blame the victim for the trauma. This can lead to withdrawal from social relations and prevent processing of the trauma by discussing it with others and receiving corrective information.

Finally, physical, social, or economic consequences of the trauma may be interpreted as signaling permanent change for the worse.

Regarding memories of the trauma, Ehlers and Clark (2000) point to their puzzling double nature. On one hand, trauma survivors with PTSD may have difficulties intentionally retrieving comprehensive memories of the event, and their recall may be fragmented or poorly organized and ordered. On the other, they also have frequent involuntary, vivid and emotional recollections or re-experiences of the event triggered by a range of stimuli that often relate to the event only peripherally.

The way the trauma is encoded into memory could explain these peculiar characteristics (Ehlers & Clark, 2000). First, in individuals who go on to develop PTSD, the traumatic memory is poorly elaborated and insufficiently integrated into its context in time and place, in relation to subsequent and previous events and other autobiographical memories. Second, associations between different stimuli and between stimuli and responses are particularly strong in traumatic memories, which explains why they and their accompanying emotions are triggered so easily by associated stimuli. PTSD persists because stimuli that were present around the time of trauma have become strongly associated with prediction of danger to self, and because trauma survivors with PTSD are commonly not even aware of what triggered the re-experiencing and thus cannot learn that they do not signal danger in the present. Ehlers and Clark (2000) further suggest that there is strong perceptual priming for trauma-related stimuli, meaning a lower perceptual threshold for the trauma survivor to notice similar stimuli in the environment.

Maladaptive, negative appraisals and traumatic memories interact in that appraisals may bias recall and lead to selective retrieval, which prevent the trauma survivor from remembering aspects of the event that might challenge the appraisals (Ehlers & Clark, 2000). Simultaneously, inability to remember parts of the trauma may be appraised as evidence that something is wrong with the survivor or that something even more terrible happened, contributing to the sense of current threat. More general autobiographical memory dysfunction leading to more cue-driven and less context-filtered recollection may also occur.

Ehlers and Clark (2000) argue that the sense of serious, current threat then motivates the trauma survivor to engage in behavioral and cognitive responses that, though aimed at reducing immediate distress, end up producing symptoms and preventing changes in negative appraisals and the traumatic memory. Such responses include thought suppression, rumination, selective attention to threat cues, safety behaviors, avoidance of trauma reminders, and substance abuse.

What determines the type of appraisals and memories trauma survivors develop after trauma? Ehlers and Clark (2000) identify several features of cognitive processing during the traumatic event that play a role. First, mental defeat or perceived loss of autonomy and control during the trauma may inspire later appraisals of the self as incapable, not worthy, or damaged. Second, the nature of the traumatic memory depends on whether processing at the time of trauma is more *conceptual*, relating the event to meanings, organization, and context, or *data-driven* and based on sensory impressions. Data-driven processing may lead to trauma memories that are difficult to intentionally retrieve, but include strongly perceptually primed stimuli and are poorly discriminated from other memories. Inability to establish a self-referential perspective and integrate the trauma into autobiographical memory through conceptual processing may contribute to lack of organization in the resulting memories. Dissociation, emotional numbing, and reduced ability to judge whether some aspects of the trauma are true or not may also affect the resulting memories. Characteristics of the trauma, previous experiences and beliefs, as well as individual trait and state factors may in turn have a significant effect on whether processing is likely to be more data- or conceptually-driven and what sort of appraisals develop as a result.

The cognitive model by Ehlers and Clark (2000) emphasizes that intrusive memories are distinguished from regular episodic memories by lack of temporal context, awareness of the fact that they are memories from the past. Thus, the accompanying emotions and physical and motor responses correspond to those experienced at the time of trauma, and there is a strong sense of experiencing the trauma here and now. Trauma survivors with PTSD may also experience physiological sensations or emotions associated with the trauma without recollecting the event itself in what Ehlers and Clark (2000, p. 324) termed "affect without recollection". When experiencing intrusive memories or affects, trauma survivors appear unable to put them into context or receive corrective information to what they felt or believed at the time of trauma.

As regards the applicability of the cognitive model to children and adolescents, Ehlers and Clark (2000) suggest that the nature of peritraumatic processing is important for their PTSS, as well. Younger children may even be especially prone to engaging in data-driven processing during traumatic events such as sexual abuse, as they may have trouble conceptualizing what exactly is happening to them. In relation to negative appraisals of the trauma and its consequences, the level of cognitive capacity required for more abstract fears and concerns like going crazy or losing control are present by middle childhood (Meiser-Stedman, 2002). Even younger

children may be concerned with, e.g., having been somehow broken by their traumatic experiences (Salmon & Bryant, 2002). The younger the child, the more their appraisals and beliefs are influenced by the reactions and messages of their family and other adults (Meiser-Stedman, 2002). I consider evidence on whether the nature of children's traumatic memories and coping strategies correspond to those hypothesized by the cognitive model in Sections 4.3.2 and 4.3.3 below. The development of successful treatment models specifically aimed at children and adolescents based on the cognitive model speaks for its applicability (Smith, Perrin, Yule, & Clark, 2010; see also Section 3.1 below).

In terms of recovery from persistent PTSD, the model suggests putting the trauma appropriately in the past to be central (Ehlers & Clark, 2000). This requires change in three areas: 1) elaboration and integration of the traumatic memory into the trauma survivor's autobiography; 2) modification of problematic appraisals of the trauma and its consequences, which are keeping up the sense of current threat; and 3) relinquishing dysfunctional behaviors and cognitive strategies that are preventing the above changes and making symptoms worse. In treatment, bringing about these changes is likely to require reliving the traumatic event in some form, identifying particularly emotional hot spots in memory and associated problematic appraisals, and cognitive restructuring to discuss these appraisals and alternative interpretations.

2.4.2 Emotional processing theory and fear structures

Lang's (1977) bioinformational theory suggested that emotional images are stored in memory as propositional constructions, networks of propositional units containing information about stimuli, responses (behavioral, verbal, physiological), and interpretations about the meaning of these stimuli and responses related to emotional events. Applying this thinking, Foa and Kozak (1986) formulated emotional processing theory (EPT) and proposed that fear, too, is represented in such memory structures that essentially function as blueprints for fear behavior or programs for avoiding or escaping from danger (Foa, Steketee, & Rothbaum, 1989). The essential feature distinguishing such fear structures from other informational structures are meanings of threat, danger, and escape from threat linked to its constitutive stimuli and responses.

Foa and Kozak (1986) further distinguished between what they called normal and pathological fear structures. While normal fear structures contain realistic and

adaptive representations and associations that promote avoidance of dangerous situations, pathological fear structures are excessively expansive in response elements, resistant to modification, and may contain meaning representations that conflict with or distort reality. They may incorporate beliefs that anxiety will always persist until escape, exaggerated probabilities for psychological or physical harm linked to fear responses, and high negative valence or cost for such potential threats.

Applying EPT to PTSD, Foa et al. (1989) suggested that fear structures of trauma survivors who develop PTSD, such as that presented in Figure 2c, show three distinctive features: The particular intensity of the responses, the expansive size of the structure, and its easy accessibility. The monumental traumatic event violates previous beliefs about predictability and safety. The resulting fear structure will therefore link many internal and external stimuli with meanings of danger and threat. Such an expansive fear structure is then easily activated by basically harmless stimuli, resulting in strong responses such as bursts of arousal and startling, re-experiencing the event as flashbacks or nightmares, and only temporarily successful attempts to avoid or escape the fear reaction.

EPT (Foa & Kozak, 1986; Foa et al., 2006) holds that pathological fear structures persist because avoidance and cognitive biases prevent the acquisition of information incompatible with their elements. There are thus two conditions for resolving or emotionally processing the fear structure, and thus, reducing PTSS (Foa & Kozak, 1986). First, the fear structure must become activated with the accompanying evocation of fear and stay activated long enough for habituation to anxiety to occur. Second, corrective information that is incompatible with the propositions contained in the fear structure relating to the experience and its meaning needs to be provided and integrated. This can be interoceptive information about absence or weakening of physiological arousal, or more cognitive information about lack of expected harm. Encoding this incompatible information into the structure weakens the existing links between stimuli and responses and decreases the likelihood that such responses are evoked in the future by information now matching only some elements of the structure. Meanings of threat associated with the fear responses can also diminish, as information about the lack of any real danger and the reduction of fear and anxiety even without avoidance or escape is integrated.

In natural recovery after exposure to trauma, this emotional processing occurs in the daily life of the trauma survivor as she/he engages with thoughts and feelings related to the trauma, sharing them with others and confronting trauma reminders, and thus repeatedly activates and modifies the fear structure (Foa & Cahill, 2001). However, trauma survivors who engage in thought suppression and behavioral

avoidance of trauma-related stimuli will not experience the necessary habituation to their negative emotions nor receive enough disconfirming information in daily situations to challenge their negative posttraumatic beliefs and process the trauma emotionally. They may thus develop chronic PTSS. EPT argues that chronic or more severe traumatic exposure results in fear structures with more stimuli and responses of greater intensity. Such larger structures may require more matching elements to become fully activated and malleable, which is unlikely to happen accidentally in daily life (Foa et al., 1989). The intense responses in turn may mean that when such activation does take place, arousal is excessive and impedes habituation and incorporation of corrective information. This is why recovery from repeated trauma is even more difficult.

In active treatment of PTSD, on the other hand, the fear structure needs to be intentionally activated (Foa et al., 1989). This it achieved by introducing a sufficient number of stimuli or information elements similar to those in the fear structure to the therapeutic context. The full activation of a PTSD-related fear structure, may be more difficult than one related to, for example, a simple phobia. This is because such a large structure is likely less coherent and cohesive and hence more difficult to activate in its entirety, as well as by the trauma survivor's attempts to avoid activation of strong responses. After the fear structure is activated and the accompanying fear or anxiety evoked, habituation can occur over a prolonged period of exposure. Disconfirming information can be received from both the habituation itself and the repeated activation of the fear structure in the safe and unthreatening therapeutic context, which works to reduce exaggerated probabilities of threat and excessively negative valence of the imagined outcomes.

The inhibitory learning framework to exposure (Craske et al., 2008; Craske, Treanor, Conway, Zbozinek, & Vervliet, 2014) has challenged this original formulation of EPT emphasizing the importance of habituation to fear and anxiety during sessions to some extent. This framework suggests that, instead of degradation or replacement of the link between the feared stimulus and the (emotional) response through habituation, learning a new, inhibiting link between the stimulus and lack of threat or danger that competes with the original link is paramount to treating anxiety and fear via exposure. Empirical findings on the relevance of the sort of habituation to fear the original formulation of EPT suggested as crucial to healing from PTSD have also been decidedly mixed. In some studies, within-session habituation has been linked to improvements in symptoms (de Kleine, Hendriks, Becker, & van Minnen, 2017; van Minnen & Hagenaars, 2005), but other studies have not found such a link (Sripada & Rauch, 2015; van Minnen & Foa, 2006).

In a later update to EPT, Foa et al. (2006) acknowledged that empirical research has not supported all aspects of the theory as originally formulated and conceded that within-session habituation may not be a necessary condition or reliable indicator for emotional processing. However, this does not mean the end of EPT, as we may see the modification of problematic and erroneous associations by incorporation of disconfirming information as a crucial underlying mechanism, rather than simple habituation. Foa et al. (2006) further granted that old associations between feared stimuli and emotional responses are not eliminated or replaced during exposure, but rather new competing associations, or possibly a new fear structure, are acquired, and both are retained in memory. Which structure and its associated behaviors, emotions, and cognitions becomes activated is then context-dependent. These updates to EPT bring it in line with the inhibitory learning framework.

The majority of theorizing related to EPT involves adults and adult posttraumatic reactions. However, successful treatment models specific to adolescents have been developed on the basis of EPT, as well, as discussed below in Section 3.1 (Foa, Chrestman, & Gilboa-Schechtman, 2008). Considering younger children, Salmon and Bryant (2002) note particular developmental issues that may affect the development and maintenance of PTSS, as understood by EPT. First, children's knowledge base and level of language development influence how traumatic events will be encoded and represented in fear structures. For a younger child, the resulting memories may be less detailed and more prone to forgetting, omission, errors, and misleading suggestions, while features of the event beyond the child's usual experience may not be understood or correctly represented. This holds importance for the subsequent emotional response. On one hand, more limited appraisal and encoding may protect a younger children from realizing the full disturbing extent of an event. On the other hand, the child may be more vulnerable to misinterpretations, misattributions, and unrealistic fears involving additional distress. Second, if pathological fear structures and the associated intrusive thoughts are maintained by avoidant strategies, young children's limited ability to suppress and manage their thoughts before middle childhood may in fact provide additional opportunities for adaptation in daily life. At the same time, however, with immature understanding of their own thinking and emotions, children may be less capable of reporting their thoughts to others and using more adaptive coping strategies.

Finally, it is important to note that younger children have limited strategies for intentionally retrieving memories on their own (Salmon & Bryant, 2002). Together with limited vocabulary and reduced tendency to initiate conversations, this may deprive children of opportunities for natural recovery from PTSS through

reappraising the trauma and receiving corrective information from others, especially parents. Following a traumatic event, discussions with adults are thus crucial to children's emotion regulation and coping abilities, improved accuracy of their traumatic memories, and subsequent recovery from PTSS.

2.4.3 Dual representation theory

The suggested dual nature of traumatic memories, on one hand as poorly elaborated, intentionally recalled, integrated, and contextualized and on the other as strongly associative and easily activated, vivid, and rich in sensory content, is taken by some theorists as evidence that traumatic events indeed result in and are stored in two differing representations in memory. A central such dual representation theory is the aptly named dual representation theory by Brewin et al. (1996). Brewin et al. (1996) base their theory on findings suggesting that sensory input is processed both consciously and non-consciously, with the output of these two forms of processing stored separately, in different locations or codes. As shown in Figure 2b, in the case of trauma, Brewin et al. (1996) name the two distinct representations of traumatic memories *verbally accessible memories* (VAM) and *situationally accessible memories* (SAM). VAMs are selective, abstract declarative representations of the event consciously available for retrieval and manipulation from autobiographical storage. SAMs cannot be deliberately accessed, but may become activated automatically when internal or external trauma reminders are present. SAMs are thought to hold low-level representations of the sensory, physiological, affective, and motor aspects of the trauma in the form of analogical codes that make it possible to recreate the original experience. Memories of traumatic events stored under extreme stress would result in SAMs lacking a typical association to VAMs. The meanings ascribed to the traumatic event may also differ in VAMs and SAMs.

Dual representation theory argues that cognitive-emotional processing after trauma involves both activating the SAMs to supply sensory and physiological information to the VAMs and conscious attempts to accommodate incompatible trauma-related information (Brewin et al., 1996). This may require editing the VAMs to bring them into line with previous expectations as well as preventing the automatic reactivation of the SAMs by incorporating new information into them or creating new alternative SAMs through habituation or other means. The intended result of this process is to restore a sense of safety and control, while adjusting one's expectations about self and the world accordingly.

Brewin et al. (1996) note three possible outcomes of such cognitive-emotional processing. If memories of the trauma are sufficiently processed and integrated with other memories and sense of self, there is completion or integration. This requires enough repetitions of the event in memory, reduction in negative affect by restoring a sense of control, and habituation. Another possibility is chronic emotional processing. Because of factors such as insurmountable incompatibility between trauma information and previous assumptions, competing demands, aversive secondary emotions, lack of possibilities to share and get social support, or recurring threat reactivating the SAMs, the traumatic memories cannot be integrated. The trauma survivor is then chronically and permanently preoccupied with the trauma, its consequences, and intrusive memories, resulting in chronic PTSS such as hyperarousal and avoidance as well as attentional and memory biases.

A final, third possibility is that processing is inhibited prematurely (Brewin et al., 1996). Avoidance of reactivation of the traumatic memory becomes automatic with enough repetitions, and although the fact of the trauma may be integrated into the VAMs, and SAMs do not resurface in normal circumstances, they may still be accessible under specific conditions. Such an end result might manifest as continued attentional biases, impaired memory for the trauma, phobic avoidance of trauma reminders and somatization. Dissociation during trauma and repressive coping styles combined with some ability to prevent the intrusion of SAMs into consciousness might lead to such premature inhibition.

Brewin et al. (2010) updated dual representation theory and attempted to ground it in clinical and neuroscientific advances. They argue that the absence of context in SAMs, which they rebrand as *representations in sensation-based memory* or S-reps, is due to that system being supported primarily by subcortical structures and areas involved in sensory perception and interoception, without hippocampal involvement. VAMs, or *representations in contextual memory*, C-reps, on the other hand, are argued to depend on prefrontal areas and the hippocampus.

Usually following a strong emotional event where a more enduring S-rep is created, it would remain associated with a corresponding C-rep, providing semantic and autobiographical context and allowing for top-down control, retrieval, or suppression of retrieval as required (Brewin et al., 2010). However, a loss of association between S-reps and C-reps may result from diminished hippocampal function and narrowing of attention under extreme stress. The traumatic event is then mainly encoded in isolated, strong S-reps and not all information reaches weaker C-reps where it could receive spatiotemporal context. Bottom-up activation of the unintegrated S-rep corresponds to an involuntary flashback. Brewin et al.

(2010) see flashbacks as a basically adaptive process, allowing for stored sensory information relevant for future survival to be re-processed in detail after the danger is past. PTSD is then a result of failure to attend to this re-presented information and of avoidance of traumatic sensory content, which never becomes associated with its context. Brewin et al. (2010) stress that intrusive images and memories commonly occur in many psychological disorders, not just PTSD, with their theme and content matching the sort of thoughts associated with each disorder. They suggest, however, that intrusions in PTSD are more associated with helplessness, dissociative qualities and feelings of reliving the event in the here and now. Memory disturbance both causes PTSD and maintains the disorder.

In terms of treatment, dual representation theory originally predicted that simple exposure treatment would be only effective for extinguishing emotional reactions felt during the trauma, particularly fear, but not secondary emotions like anger or guilt, which would indeed block habituation to fear (Brewin et al., 1996). This suggests that secondary emotions should be addressed by cognitive methods prior to exposure. In light of (revised) dual representation theory, recovery from intrusive symptoms might happen by holding automatically activated S-reps in attention long enough for their details to be transferred into more elaborated C-reps and integrated with existing autobiographical information, simultaneously enhancing the association between S-reps and C-reps (Brewin et al., 2010). The idea that two memory systems exist where one acts to arouse fear and prepare for action and another to modulate fear by contextualizing it could explain the success of exposure therapy for PTSD.

Little explicit discussion of the applicability of dual representation theory to children and adolescents has been presented. Meiser-Stedman (2002) argued that children, too, form both VAMs and SAMs and that the nature of SAMs may be of explanatory relevance to their reactions to trauma, as well. Certainly, children, too, do experience unwanted thoughts and flashbacks of traumatic events as well as physiological reactivity to trauma reminders, and their traumatic memories may also have strong somatic, behavioral, and visual qualities (Brewin, 2014; Meiser-Stedman, 2002; See also Section 4.3.2 below).

Rubin, Boals, and Berntsen (2008) strongly challenged dual representation theory, and indeed all models they saw as arguing for a *special mechanism view of memory in PTSD* (including the cognitive model by Ehlers and Clark, 2000). In what Rubin et al. (2008) term the *basic mechanisms view of memory in PTSD*, voluntary and involuntary recall of the trauma take place through the same memory system, though in different ways: associative, uncontrolled spreading of activation in involuntary memories and

controlled narrative and schema-based search in voluntary memories. The difference in retrieval process accounts for involuntary memories having more emotional impact and less life story relevance. However, no difference is expected to exist in availability of involuntary or voluntary memories: Access to the memory through both paths of retrieval is enhanced in PTSD due to the high emotional arousal during trauma. To the claim that dual representation theory requires an empirically unsupported special mechanism only operating in highly emotional and stressful situations, Brewin et al. (2010; Brewin, 2014) responded that the characteristics of traumatic memories might more fruitfully be considered in terms of how ordinary memory mechanisms operate under unusual circumstances.

The at times heated discussion about the nature of traumatic memories shows no signs of abating (e.g. Brewin, 2014; 2016; 2018; Rubin, Berntsen, Ogle, Deffler, & Beckham, 2016). Evidence for the different positions is mixed and open to several interpretations (Brewin, 2014; 2018; Rubin, Berntsen et al., 2016). The difference between accounts such as those by Brewin et al. (1996; 2010) and those of Rubin et al. (2008) might perhaps more usefully be seen as clinically relevant versus more basic research oriented theorizing, with correspondingly differing aims (Dalgleish, 2004). Still, at least two clear empirical questions to which the different accounts provide differing predictions remain. 1) Are voluntary memories of trauma, and thus access to them, impaired or indeed enhanced? 2) Does a system of long-term perceptual memory representations exist in which traumatic memories might be stored, and if so, what is its relation to episodic memory?

These questions also hold relevance for treatment of PTSD in that integrating, organizing or providing context, and thereby improving access, to traumatic memories is a suggested mechanism of action in several treatments for PTSD (Foa et al., 2008; Schauer et al., 2011). All three theories presented here also suggest that such processing or modification of the traumatic memory would be relevant to treating PTSS (Brewin et al., 1996; 2010; Ehlers & Clark, 2000; Foa & Kozak, 1986; Foa et al., 2006). However, if there is no lack of coherence, organization or context in traumatic memories to begin with, as Rubin et al. (2008; Rubin, Deffler et al., 2016) suggest, such pursuits appear meaningless and should not contribute to reducing PTSS.

2.5 Consequences of trauma beyond PTSD

The construct of PTSD has received a fair share of criticism since its first modern description by Horowitz (1976) and its inclusion in the *DSM-III* (APA, 1980). PTSD has been criticized for medicalizing human suffering and the consequences of political conflicts (Afana, 2012; Breslau, 2004; Stein, Seedat, Iversen, & Wessely, 2007; Summerfield, 1999), being overused as a diagnosis (Stein et al., 2007) and lacking validity as a medical entity entirely (Afana, 2012; Summerfield, 2001, Young, 1995; see also Brewin, 2003, for a list of early concerns). Although quite similar symptoms are observed globally after exposure to trauma, criticism has also centered on the cross-cultural validity of PTSD and ignoring cultural differences in experiencing and explaining reactions to trauma (Afana, 2012; Eisenbruch, 1992; Summerfield, 1999; for reviews, see Hinton & Lewis-Fernández, 2011; Kienzler, 2008). Concerns have also been raised about the sometimes exclusive focus on PTSD in assistance provided to trauma survivors especially outside the Western world and associated research (Jordans, Pigott, & Tol, 2016; Miller, Kulkarni, & Kushner, 2006; Summerfield, 1999), with concomitant lack of attention to other mental and somatic health problems, as well as social, economic and political concerns.

Undeniably, consequences of exposure to traumatic events extend far beyond those covered by the posttraumatic stress disorder construct. More comprehensive concepts such as *social suffering* (Kienzler, 2008) may be needed to adequately characterize the manifold effects of, e.g., violence on both individuals and communities. The diagnosis and construct of PTSD is limited to imperfectly describing just some common individual mental health sequelae of trauma.

2.5.1 Comorbidity and other mental disorders

Among trauma survivors who do develop diagnosable PTSD, its symptoms rarely exist in isolation. Some comorbid disorders have their onset before any traumatic event. Such pre-existing psychopathology increases the risk for developing PTSD when traumatic events do occur (DiGangi et al., 2013). Other disorders may be directly triggered by exposure to trauma or develop after exposure because of adjustment difficulties and possible PTSS.

Comorbidity of PTSD with depression, anxiety disorders, and, among adults, substance abuse is very common (Copeland et al., 2007; Kessler et al., 1995;

Kilpatrick et al, 2003; McCauley, Killeen, Gros, Brady, & Back, 2012; Rytwinski, Scur, Feeny, & Youngstrom, 2013). For example, in a national survey of US adolescents, Kilpatrick et al. (2003) found 47% of boys with PTSD and 71% of girls to also fulfill criteria for major depression. Copeland et al. (2007) also found 37% of those adolescents with at least subclinical PTSS to have had a diagnosis of a depressive disorder during their lifetime, compared with 7% of other adolescents. Some evidence suggests developmental timing of trauma in middle childhood may particularly increase the risk for depression (Dunn et al., 2017).

Co-occurrence of PTSD and depression is to some extent explained by the fact that symptom criteria for PTSD in the *DSM-IV* and *DSM-5* overlap with those of depressive disorders. However, even with *ICD-11* criteria where such symptom overlap is minimal, co-occurrence of PTSD and depression is very common (Barbano et al., 2019). Depressive symptoms are thus a common source of additional distress and dysfunction for many who suffer from PTSS.

Traumatic experiences, especially childhood abuse and neglect, are also an important risk factor for dissociative disorders (Foote, Smolin, Kaplan, Legatt, & Lipschitz, 2006; Vonderlin et al., 2018) and the incidence of psychotic disorders and severity of positive psychotic symptoms (Bailey et al., 2018; Bendall, Jackson, Hulbert, & McGorry, 2008; Varese et al., 2012). Overall, childhood adverse events and trauma considerably increase the risk for nearly all psychiatric disorders (Green et al., 2010).

2.5.2 Possible variety of posttraumatic stress disorders

Even under the umbrella of posttraumatic stress disorders, many researchers have argued for the existence of qualitatively different subtypes or more extreme and complicated forms of PTSD. Herman (1992) was the first to describe an amplified posttraumatic stress reaction or complex PTSD (CPTSD) resulting from repeated, serious trauma, especially with features of captivity. She listed somatization, dissociation, concentration difficulties and other vegetative depressive-type symptoms, withdrawal, guilt, hopelessness, anger, self-hatred and self-injury, relational difficulties, and disturbances in identity and self-image as symptoms of such a complex manifestation. Later, van der Kolk, Roth, Pelcovitz, Sunday, & Spinazzola (2005) also argued that multiple, prolonged exposure to trauma would increase symptom complexity, with survivors of such trauma exhibiting problems in

affect regulation and impulsivity, memory and attention, perception of self and interpersonal relations, somatization, and meaning-making.

In the *DSM-5*, some of the sort of negative alterations in cognitions and emotions these researchers have considered as symptoms of CPTSD are included as possible symptoms of regular PTSD (APA, 2013). However, the *DSM-5* also recognizes a subtype of PTSD with dissociative symptoms, where depersonalization or derealization symptoms are present. These additions have led to what is likely quite a comprehensive description of manifestations of PTSD. At the same time, according to the *DSM-5*, PTSD may now be diagnosed based on more than 600,000 different combinations of symptoms (Galatzer-Levy & Bryant, 2013).

Empirical support that a subgroup with prominent dissociative symptoms can be identified among adults and adolescents with PTSD has accumulated over the last years (Choi et al., 2019; Hansen, Ross, & Armour, 2017; Ross, Baník, Dědová, Mikulášková, & Armour, 2018). However, some studies have found that those with high levels of dissociative symptoms also experience higher re-experiencing symptoms, suggesting that this group might better be characterized as suffering from particularly severe PTSS overall, instead of a distinct subtype (Burton, Feeny, Connell, & Zoellner, 2018). Further, several studies have not found forms of trauma exposure suggested to be typical for the dissociative subtype, such as repeated childhood maltreatment, to predict a dissociative manifestation (Burton et al., 2018; Choi et al., 2019; Wolf et al., 2019). These findings call into question the clinical and diagnostic relevance of a dissociative subtype. Even if a group of PTSD patients with a more dissociative presentation may be identified, their dissociative symptoms might be adequately understood as simply another type of symptoms of ordinary PTSD more common with severe symptomatology, instead of evidencing a qualitatively different subtype. Schauer and Elbert (2010) in their conceptualization stress that parasympathetic shutdown reactions involving dissociation during traumatic exposure and their re-emergence as posttraumatic stress symptoms might account for dissociative presentations of PTSD. Thus, reactions during the trauma could determine the sort of symptoms that will dominate in later PTSD.

The *ICD-11*, on the other hand, includes a separate diagnosis of *complex posttraumatic stress disorder* (CPTSD; Maercker et al., 2013; WHO, 2018). The diagnosis is to some extent a reformulation of an earlier more vague diagnosis of *enduring personality change after catastrophic experience* in the *ICD-10* (Brewin et al., 2017; WHO, 1992). In the *ICD-11*, CPTSD may be diagnosed in survivors of extremely horrific or threatening events who, in addition to the typical re-experiencing, avoidance, and hyperarousal symptoms, also experience 1) problems in affect regulation, 2) negative

beliefs about themselves and/or feelings of shame, guilt, or failure, and 3) difficulties in sustaining close relationships. Together, these symptoms are thought to represent disturbances in self-organization (Brewin et al., 2017).

Some studies have found this distinction to meaningfully separate trauma survivors with differing symptom profiles, among adults (Cloitre, Garvert, Brewin, Bryant, & Maercker, 2013; Hyland et al., 2018; Karatzias et al., 2017), as well as children and adolescents (Perkonigg et al., 2015; Sachser, Keller, & Goldbeck, 2017). However, others have found that, here too, groups might differ more in terms of severity of symptoms than the sort of differential psychopathology suggested for PTSD and CPTSD (Murphy, Elklit, Dokkedahl, & Shevlin, 2016). Alternatively, De Jongh et al. (2016) have suggested that CPTSD, at least among adults, could be more usefully and adequately described as PTSD with psychiatric comorbidities.

Finally, for children and adolescents who are still developing, traumatic experiences can profoundly affect and in some cases even re-direct their development, resulting in difficult interrelated symptoms and complex poly-diagnoses. Some researchers have proposed a comprehensive diagnosis of a *developmental trauma disorder* to more fully encompass the range of biopsychosocial consequences early and repeated exposure to especially interpersonal trauma and disruption to caregiving may have (Ford et al., 2013; Ford, Spinazzola, van der Kolk, & Grasso, 2018; van der Kolk, 2005; van der Kolk et al., 2005; van der Kolk, Ford, & Spinazzola, 2019). Defining symptoms of such a disorder would involve emotional or somatic, attentional or behavioral, and relational or self-related dysregulation. Classic PTSD symptoms would not necessarily be present. A diagnosis such as developmental trauma disorder is not included in any diagnostic systems so far.

2.6 Current operationalization

Trauma may cause, indirectly lead to and increase the risk for a variety of negative mental health outcomes. In the empirical work of this dissertation, I limit my focus to classic PTSS, that is, re-experiencing, avoidance, and hyperarousal symptoms, regardless of whether they co-occur with dissociative, self-regulative, affective, or cognitive symptoms or not. I consider alterations in cognitions that may result from traumatic experiences here as a mechanism that may lead to and keep up other symptoms and thus form a target of treatment. As described above, classic PTSS may result from exposure to either single-incident or repeated trauma. The main emphasis of this dissertation is on the consequences of repeated exposure to trauma

in the contexts of war and military violence, refugeedom, and interpersonal violence within the family.

Some research has found successful treatment of PTSS to lead to alleviation of comorbid problems such as depression (e.g., McLean, Su, Carpenter, & Foa, 2017; Norr, Smolenski, & Reger, 2018). Treating PTSS also appears to contribute to improvement in overall psychosocial functioning (Catani et al., 2009; Rauch et al., 2009; Reich, Nemeth, & Acierno, 2019). Still, my near exclusive focus on PTSS does not suggest that they should always be the first and most important target of treatment or other support. Further, I acknowledge that traumatic experiences and especially forms of violence also often have significant physical, economic, social, and even political consequences. From here on, such important areas of posttraumatic changes lie outside my scope. However, in intervention research more widely, it is vital that we actively seek to listen to both individual trauma survivors and communities to understand what forms of assistance, support, or treatment they consider most helpful, valuable, and timely in their particular circumstances.

3 PSYCHOLOGICAL TREATMENT OF POSTTRAUMATIC STRESS SYMPTOMS

Psychological treatments are effective for PTSS among adults (Cusack et al., 2016) as well as children and adolescents (Dorsey et al., 2017; Gillies et al., 2016; Leenarts, Diehle, Doreleijers, Jansma, & Lindauer, 2013; Morina, Koerssen, & Pollet, 2016). Among children and adolescents, a meta-analysis by Morina et al. (2016) found a large average effect size of $g = 0.83$ for reduction in PTSS at posttreatment when psychological interventions were compared with waitlist and a medium effect size of $g = 0.41$ when compared with active control conditions. Despite this moderate to good effectiveness, the availability of treatment and willingness to engage in it are particular problems in the treatment of PTSD. Koenen et al. (2017) found that just around half of those with probable PTSD seek treatment in high-income countries, while rates of treatment-seeking are even lower in low- and middle-income countries. With UK adolescents just entering adulthood, Lewis et al. (2019) reported that just 20% of those suffering from PTSD were receiving treatment.

3.1 Trauma-focused cognitive-behavioral treatment for children and adolescents

We can usefully divide psychological therapies for PTSS into trauma-focused and non-trauma-focused treatments. Ehlers et al. (2010) defined trauma-focused treatment as focusing on "the patients' memories of their traumatic events and the personal meanings of the trauma" (p. 270). In other words, in trauma-focused treatment, thoughts, feelings, or memories related to the traumatic event are directly addressed through methods such as imaginal or in vivo exposure, cognitive restructuring, or more generally discussing the trauma and its meaning. In contrast, non-trauma-focused treatment aims to reduce PTSS through methods such as relaxation, stress reduction techniques, skills training, changing metacognitions, or a focus on current life challenges, interpersonal and social issues, without directly targeting or discussing the trauma. Some evidence is emerging on the effectiveness of non-trauma-focused treatments such as interpersonal therapy (Felton et al., 2019;

Jiang et al., 2014; Markowitz et al., 2015), metacognitive therapy (Simons & Kursawe, 2019; Wells, Walton, Lovell, & Proctor, 2014), and mindfulness-based interventions (Boyd, Lanius, & McKinnon, 2018). However, trauma-focused treatments appear slightly more effective in treating PTSS overall (Ehlers et al., 2010; Tran & Gregor, 2016).

Among different types of treatments, the most evidence for treating PTSS among children (school-aged and older) and adolescents is available for the effectiveness of trauma-focused treatments based on principles of cognitive-behavioral therapy (CBT; Leenarts et al., 2013; Morina et al., 2016; Morina, Malek, Nickerson, & Bryant, 2017). Trauma-focused cognitive-behavioral treatments are also recommended by treatment guidelines in several countries (National Institute for Health and Care Excellence, 2018; Phoenix Australia, 2013; Ponteva et al., 2014).

I should note a source of possible confusion in terminology here. While reviewers (Morina et al. 2016; 2017) include a variety of treatments such as narrative exposure therapy (NET; Schauer et al., 2011), prolonged exposure (PE; Foa, Hembree, & Rothbaum, 2007) and cognitive processing therapy (CPT; Resick, Monson, & Chard, 2014) in the category of trauma-focused cognitive-behavioral therapy, there exists also a specific, manualized treatment called trauma-focused cognitive-behavioral therapy (TF-CBT; Cohen, Mannarino, & Deblinger, 2017). In this dissertation, I will use the capitalized acronym TF-CBT to refer to just this particular manualized treatment and trauma-focused CBT to refer to all forms of CBT that focus on or address the trauma directly.

Out of trauma-focused CBT treatments for children and adolescents, the largest number of well-designed empirical trials have indeed been carried out for TF-CBT (e.g., Cohen, Deblinger, & Mannarino, 2018; de Arellano et al., 2014). This best evidence base does not necessarily suggest the superiority of TF-CBT, as in rare head-to-head comparisons, other trauma-focused treatments such as eye-movement desensitization and reprocessing (EMDR; Shapiro, 2001) appear to achieve similar results (Diehle, Opmeer, Boer, Mannarino, & Lindauer, 2015). Besides TF-CBT, several randomized controlled trials (RCTs) have also demonstrated the effectiveness of prolonged exposure for adolescents (PE-A; Foa et al., 2008) and NET, treatments based more heavily on exposure methods (Catani et al., 2009; Ertl, Pfeiffer, Schauer, Elbert, & Neuner, 2011; Foa, McLean, Capaldi, & Rosenfield, 2013; Gilboa-Schechtman et al., 2010; Roussow, Yadin, Alexander, & Seedat, 2018; Ruf et al., 2010).

Most of my empirical research concerns children and adolescents traumatized by war and armed conflict. For children and adolescents affected by war and conflict in

low- and middle-income countries, Morina et al. (2017) found on average a medium-sized effect of $g = 0.57$ for reduction in PTSS by psychological treatment versus control conditions at posttreatment and a small effect of $g = 0.23$ at follow-up. They found no significant difference between effects of trauma-focused CBT and other active conditions in the few existing head-to-head comparisons. The authors noted possibly significant publication bias and the overall small number of studies available.

Many of our participants in Studies III and IV were refugee or asylum seeking minors. Nocon, Eberle-Sejari, Unterhitzenberger, and Rosner (2017) found some preliminary evidence for CBT treatments (including NET, TRT, TF-CBT, and other individual and group CBT interventions) for PTSS among war-traumatized refugee and internally displaced minors. However, they also noted very high heterogeneity in results and simply too few studies available on too many different interventions. Results of treatment also appeared less promising than among children and adolescents with PTSD overall. Using more stringent inclusion criteria, Morina and Sterr (2019) found just eight randomized controlled trials of psychological treatments for PTSS among refugee and internally displaced children. They concluded that there was no overall evidence of significant effects of psychological treatments on PTSS among this population and called for more research. War-affected children and adolescents and especially refugee and asylum seeker minors remain a seriously understudied population. Our trials of TRT and NET are significant contributions in this respect. In relation to treatment of refugee minors already resettled into high-income countries, Fazel's (2018) non-systematic review suggested that NET has the strongest evidence base so far. She noted, however, that much of the evidence comes from studies with lay counsellors in low- and middle-income countries and should be replicated in a high-income context, as well as compared with other treatments such as EMDR. This is exactly where Studies III and IV provide novel evidence on feasibility and effectiveness.

Finally, our participants in Studies III and IV also included some children and adolescents with trauma related to physical or sexual abuse in the family. Leenarts et al. (2013) found TF-CBT to have the strongest evidence base among children and adolescents exposed to childhood maltreatment, too. The effectiveness of NET has not been studied among children and adolescents traumatized by violence within the family, so this is another important contribution of Studies III and IV.

3.2 Narrative exposure therapy

The intervention we trialed in Studies III and IV is narrative exposure therapy (NET; Schauer et al., 2011). NET is a manualized, individual form of trauma-focused CBT designed for the treatment of PTSD resulting from exposure to war or organized violence or other repeated traumatic events.

NET draws inspiration from prolonged exposure approaches (Foa & Rothbaum, 1998) as well as testimonial therapy as developed by Chilean psychologists Lira and Weinstein in the context of political violence (Cienfuegos & Monelli, 1983). Consequently, two central healing processes are argued to account for the effectiveness of NET in reducing PTSS: weaving sensory and emotional implicit memories or *hot* memories back into their spatiotemporal context in declarative *cold* memories, and documenting and acknowledging the human-rights violations and wrongs the trauma survivor has experienced (Elbert & Schauer, 2002; Metcalfe & Jacobs, 1998; Schauer et al., 2011).

The core of NET treatment consists of the trauma survivor telling their life story chronologically and in detail to a trained counselor or therapist, typically over 5–12 sessions. The therapist writes down the story, reads it back to the client, and assists him or her in integrating his/her traumatic memories into the emerging coherent life narrative (Schauer et al., 2011). When arriving at traumatic events in the life story, the therapist encourages the survivor to engage in detailed imaginative exposure to the events in slow motion, asking the client about the sensory information, emotions, cognitions, and physiological reactions they experienced during the time of trauma and recording them carefully. The therapist also notes reactions observed in the patient at the time of treatment that might reflect peri-traumatic experiences. In line with ideas of EPT (Foa & Kozak, 1986), this attention to different types of responses in the fear structure increases the likelihood of fully activating the structure and making it possible to modify it and link it back to its proper context in time and place, reducing its tendency to become unintentionally and uncontrollably activated.

NET is suitable for adults as well as children and adolescents, with slight modifications suggested for treating children (Schauer, Neuner, & Elbert, 2017). The developers of NET further argue that its focus on narration as a healing process makes NET a rather culturally universal intervention (Schauer et al., 2011). Indeed, field-testing and research on NET has taken place in a wide variety of cultures and contexts globally. Among adults, evidence on the effectiveness of NET has already accumulated from a number of trials around the world (reviewed in Lely, Smid, Jongedijk, Knipscheer, & Kleber, 2019; Mørkved et al., 2014; Robjant & Fazel,

2010). Most similar to our Study III is the pragmatic RCT by Stenmark, Catani, Neuner, Elbert, and Holen (2013) that compared NET with TAU within the Norwegian healthcare system among adult refugees and asylum seekers. With 81 participants treated out at 11 different units, they found NET to reduce PTSS significantly more than TAU, with a moderate-sized effect lasting up to a six-month follow-up.

There were four RCTs on NET involving children and adolescents available before our study commenced. First, among 31 8–14-year-old Sri Lankan children affected by war and a very recent tsunami, an RCT by Catani et al. (2009) found NET to be associated with similar, large reductions in PTSS as a meditation-relaxation program developed in consultation by local experts. Second, among 26 Rwandan genocide orphans 14–28 years of age, Schaal, Elbert, and Neuner (2009) found a condensed three-session implementation of NET combined with one session of group grieving to lead to similar reductions in PTSS levels and PTSD diagnoses at posttreatment as group-based interpersonal therapy of similar length. However, at six-month follow-up, NET participants had continued to improve, while interpersonal therapy participants had experienced some return of symptoms Reductions in PTSS and PTSD diagnoses were now significantly greater in the NET group, as were improvements in depression and feelings of guilt. Third, in an RCT with 85 former child soldiers 12–25 years of age in Uganda, Ertl et al. (2011) compared NET provided by local lay counselors with a program of academic catch-up and supportive counseling and with a waitlist condition. They found NET superior in reducing PTSS with a moderate effect size compared to both control conditions. Interestingly, NET participants again continued to experience reductions in symptoms until a twelve-month follow-up and the differences between the groups only really became apparent from six months after treatment onwards. Finally, an RCT among 26 refugee children and adolescents aged 7–16 resettled into Germany found NET to have large effects on PTSS up to twelve months after treatment, as compared with a waitlist (Ruf et al., 2010). Six months after treatment, only 2/12 of NET participants still presented with diagnosable PTSD.

Together, these studies already provide some evidence on the effectiveness of NET in treating PTSS among multiply traumatized children and adolescents. They also demonstrate the feasibility and safety of implementing NET in a variety of contexts, including with lay counselors in low-resource environments. However, the small study by Ruf et al. (2010) is the only one carried out in a high-income country. Further, none of these studies took place in conditions of usual care. Authors such as Nickerson, Bryant, Silove, and Steel (2011) have criticized the fact that too many

studies on PTSD treatment among refugees seem to take place at university centers or specialized clinics, as was the case with Ruf et al. (2010) as well, and recommended real-world settings to really test the effects of treatments in clinical practice. To my knowledge, no pragmatic trials of any trauma-focused CBT treatment in usual care environments have been carried out in samples of multiply traumatized children and adolescents with predominantly war-related trauma before our study.

All the previous NET studies involved children and adolescents with war-related trauma. Though such organized violence has been a particular focus in its development, Schauer et al. (2011) suggest NET to be suitable for treatment of children and adolescents multiply traumatized by domestic physical or sexual abuse, as well. Finally, no studies have examined the possible psychological mechanisms of change involved in NET, whether among children or adults. These are unique contributions of our Studies III and IV.

3.3 Group psychosocial interventions

Apart from individual therapy, group-based treatments and interventions for PTSS among children and adolescents have also been developed and evaluated in empirical studies. The development of group psychosocial interventions that could be implemented easily and cost-effectively, for example in schools, in areas with limited resources and trained mental health professionals available has been of particular interest. Such interventions might be especially important for low- and middle-income countries affected by war or conflict, where the provision of individual therapy to all of the many children traumatized by war might be unrealistic.

Some meta-analyses aggregating all types of group psychosocial interventions have found them to produce small or no significant effects on PTSS compared with a waitlist (Morina et al., 2016; 2017). In contrast, Brown et al. (2017) found the effects of group psychosocial interventions versus control conditions to be similar to those of EMDR, NET or other CBT treatments for children and adolescents exposed to natural disasters, terrorism, or war. They did point out the great heterogeneity in effects and quality of studies, however.

In any case, there is significant heterogeneity in the type and content of different group psychosocial interventions, and meta-analyses aggregating the effects of such differing interventions may be misleading. One example, the Classroom-Based Intervention trialed by Tol et al. (2012; 2014) in several low-income countries combines CBT techniques such as psychoeducation, coping-oriented activities, and

discussion of traumatic events with creative-expressive elements. Another, the ERASE Stress intervention (Berger & Gelkopf, 2009), includes similar CBT elements, but also meditation and assigned homework. A further intervention trialed in Palestine in the context of ongoing conflict (Thabet, Vostanis, & Karim, 2005) mainly contained creative and non-active techniques such as drawing, storytelling, and expressing emotions, aimed at stress reduction. The providers of treatment also vary according to intervention and may include teachers, counsellors or local or outside mental health specialists, as does length and intensity of the interventions. With such varied contents and features, it may not make sense to speak of or research all group psychosocial interventions and their effectiveness in aggregate.

Group psychosocial interventions are often described as preventive or supportive and not as treatments for PTSS per se. Thus, even if they do not produce large reductions in PTSS, we might perceive them as at least worth a try or better than nothing in cases where individualized therapy is not feasible. However, the benign nature of group psychosocial interventions has been called into question. The Classroom-Based Intervention trials by Tol et al. (2012; 2014) resulting in generally null findings on overall reduction in PTSS and inconsistent findings on factors possibly moderating treatment effects have led to its developers themselves as well as commentators (Ertl & Neuner, 2014) to caution against its use, at least in its current form with trauma-focused elements. It is conceivable based on the evidence that treatments such as this could result in harm to some students or interfere with natural recovery processes (Ertl & Neuner, 2014). We cannot really generalize findings from one intervention to another. Careful, methodologically sound trials with large enough samples are needed to determine whether particular psychosocial group interventions are helpful or at the very least not harmful for trauma-exposed children and adolescents.

3.4 Teaching Recovery Techniques

The Teaching Recovery Techniques intervention (TRT; Smith et al., 2000) employed in Study II is a group- or classroom-based psychosocial intervention for children and adolescents partly based on CBT principles. Its stated goals are not to cure symptoms as such, but improve children's coping in the aftermath of war by providing them with better coping strategies and getting them to feel more in control of their reactions. Children might then be more able to take advantage of the support available to them from their families and schools, and this could reduce the need for

later treatment. TRT was designed so that it could be used with minimal training and supervision. As treatment components, the TRT intervention includes imagery techniques to enhance feelings of mastery and control, distraction techniques, identification of reactions and emotions, relaxation and breathing exercises, cognitive methods for developing a more adaptive self-image and reducing avoidance, sleep hygiene, as well as creative-expressive methods such as drawing and writing about one's experiences.

TRT has been trialed in a number of studies in different contexts. Three studies have evaluated its effectiveness after natural disasters. In a pilot study two months after the Athens earthquake of 1999 among 20 children 8–12 years of age with mild to moderate PTSS, Giannopoulou, Dikaiakou, and Yule (2006) reported significant reductions in PTSS at posttreatment and further reduction at an 18-month follow-up. In Iran, Shooshtary, Panaghi, and Moghadam (2008) studied the effectiveness of TRT in a non-randomized controlled trial after the 2003 Bam earthquake among 168 adolescents (mean age 15.5) and reported significant reductions in PTSS at posttreatment. In Thailand four years after the 2004 tsunami, in a randomized, waitlist-controlled trial, Pityaratstsian et al. (2015) tested a brief, condensed version of TRT delivered over three days among 36 children aged 10–15 diagnosed with chronic PTSD. A significant, small to medium-sized effect of condensed TRT was observed on PTSS at 1-month follow-up, but not immediately posttreatment.

Several studies are also available on TRT among children and adolescents with war-related trauma. Among 26 refugees or asylum seekers 11–15-years old in the UK traumatized by war, a waitlist-controlled study by Ehntholt, Smith, and Yule (2005) found TRT to lead to statistically significant though clinically quite modest improvements in PTSS. The improvements did not appear to be maintained at two-month follow-up, however. Barron, Abdallah, and Smith (2013) carried out an RCT of TRT versus waitlist control among 140 children 11–13 years old in the West Bank, Palestine. They reported that TRT significantly reduced PTSS compared with waitlist, but the interpretability of these results is hampered by notable differences in symptom levels between intervention and control groups at pretreatment. In a second RCT among 139 highly symptomatic 11–15-year-old adolescents in rural Palestine, Barron, Abdallah and Heltne (2016) reported a medium effect of TRT on PTSS at posttreatment and a significant reduction in the share of adolescents with probable PTSD after TRT. In contrast, in an uncontrolled study in the context of still on-going violence in Baghdad, Iraq, Ali, Al-Joudi, and Snell (2019) found no significant overall reduction in PTSS after TRT was provided to 102 adolescents 13-18 years of age.

Primary analyses of the data employed here in Study II indicated that in a cluster-randomized controlled trial among 482 war-affected children 10–13 years old in Gaza, Palestine, TRT reduced rates of probable PTSD among boys and levels of PTSS and rates of probable PTSD among girls with low levels of peritraumatic dissociation (Qouta, Palosaari, Diab, & Punamäki, 2012). However, in his Doctoral dissertation, Palosaari (2016) noted that all these significant effects would disappear if appropriate corrections for multiple testing were applied. Recently, an uncontrolled pilot study of TRT among unaccompanied refugee minors in Sweden with 48 participants also reported modest but statistically significant reductions in PTSS and depression at posttreatment (Sarkadi et al., 2018). Finally, in an RCT among 20 adolescents aged 12–18 living in a secure facility in Scotland, a modified version of TRT did not lead to significant reductions in PTSS or other mental health symptoms, compared with waitlist (Barron, Mitchell, & Yule, 2017).

In sum, there is some evidence for small to medium effects of TRT on PTSS at least immediately posttreatment, but contrary findings have also been reported. Larger, more methodologically sound studies are called for. It is still unclear what explains TRT's apparently differential effects in different contexts and for different groups of children and adolescents. Importantly for this dissertation, the effects of TRT on posttraumatic cognitions have not been previously tested. Understanding how TRT leads to symptom reduction, when it does, could be key to clarifying when and where it and similar group psychosocial interventions are effective and called for. This is where Study II contributes in relation to changes in negative posttraumatic cognitions.

3.5 Treatment of complex trauma

The children and adolescents participating in our empirical studies had been traumatized by repeated exposure to trauma in the form of war and conflict or physical or sexual abuse in the family. Following Herman (1992), the *ISTSS Expert Consensus Treatment Guidelines for Complex PTSD in Adults* (Cloitre et al., 2012) defined complex trauma as "exposure to repeated or prolonged instances or multiple forms of interpersonal trauma, often occurring under circumstances where escape is not possible due to physical, psychological, maturational, family/environmental, or social constraints" (p. 4). In many cases, both exposure to war or conflict and prolonged domestic violence could be examples of such complex trauma.

Repeated, complex trauma is suggested to be strongly associated with CPTSD (Herman, 1992; Roth, Newman, Pelcovitz, van der Kolk, & Mandel, 1997; WHO, 2018). However, in relation to experiences of war and refugeedom, ter Heide, Mooren, and Kleber (2016) have argued that while exposure to complex trauma is, almost by definition, common among refugees, only a minority of refugees actually fulfill diagnostic criteria for CPTSD. The symptoms of many more are more appropriately characterized as regular PTSD. Some studies among refugees living in temporary shelters near their country of origin (De Jong, Komproe, Spinazzola, van der Kolk, & van Ommeren, 2005) and among treatment-seeking refugees resettled into a high-income European country (Teodorescu, Heir, Hauff, Wentzel-Larsen, & Lien, 2012) suggest that despite massive exposure to complex trauma, symptom profiles corresponding to CPTSD may be relatively uncommon among refugees. A study of young adults affected by war in Uganda also found higher rates for simple versus complex PTSD (Murphy et al., 2016). In contrast, Hyland et al. (2018) did find somewhat higher rates of CPTSD (36%) compared with simple PTSD (25%) in a sample of adult Syrian refugees in Lebanon, as did Nickerson et al. (2016) (33% vs. 20%) among tortured adult refugees resettled in Switzerland.

Although CPTSD, for example as defined by the *ICD-11* (WHO, 2018), can be diagnosed in children and adolescents as well, studies on the prevalence and indeed even the validity of the concept among war-exposed children and adolescents are lacking. One register-based study in the UK did find that 36% of trafficked children with PTSD and 8% overall fulfilled diagnostic criteria for CTPSD, with multiple trauma exposure associated with more CPTSD symptoms (Ottisova, Smith, & Oram, 2018). However, a small number of trafficked children with PTSD were identified overall.

Is the nature of PTSD manifestation as complex or simple relevant for treatment? Treatment guidelines on evidence-based practices list trauma-focused CBT as first-line interventions for PTSD. On the other hand, the ISTSS guidelines (Cloitre et al., 2012) argue that in case of CPTSD, stepped or phased treatment is called for. In a phased approach, a first phase, typically lasting several months, focused on stabilization, skills training, coping, safety, and symptom reduction should be carried out before the trauma is tackled directly in the second phase via approaches such as exposure or cognitive restructuring.

A large group of prominent trauma researchers and intervention developers have questioned the evidence base of these guidelines (De Jongh et al., 2016). They argue that a sizeable body of evidence instead demonstrates that patients with repeated interpersonal trauma such as childhood sexual abuse, as well as those with a more

complex presentation of symptoms or comorbid disorders, benefit from trauma-focused treatment without a preceding stabilization phase and do not experience adverse effects or higher dropout during them. Restricting access to trauma-focused treatment or delaying it by introducing a stabilization or skills-training phase may even be harmful in that patients may become demoralized and unmotivated. Further, labeling a patient as complex or complicated might cause iatrogenic risks of convincing them that treatments will not be effective for them.

Very few controlled studies on stepped or phased care approaches exist. In the only head-to-head comparison, among adults exposed to childhood physical or sexual abuse, Cloitre et al. (2010) found a combination of skills training and exposure treatment to lead to larger reductions in PTSS at six-month follow-up than either combination of skills training and supportive counseling or supportive counseling and exposure. However, the results are difficult to interpret, as in practice the participants in the skills training and exposure condition received 50% more active treatment than other participants.

The few controlled studies available on stabilization or skills training interventions by themselves also provide little evidence of their benefits, at least in terms of symptom reduction. For example, Dorepaal et al. (2012) found among adults with CPTSD and severe comorbidity that a full 20 weeks of stabilizing group treatment did not lead to reduced PTSS compared with TAU. Further, although stabilizing treatment is intended to reduce dropouts, 18% of patients dropped out during the treatment, a typical rate for active treatments for PTSS (Imel et al., 2013). Ford, Steinberg, and Zhang (2011) found no difference in PTSS reduction with 12 sessions of an affect regulation training program compared with present centered therapy among women with victimization-related PTSD. Dropout rates were again relatively high (25%) and similar in both groups. A small pilot study carried out by our research group among unaccompanied minor asylum seekers also did not find a stabilization-oriented group intervention to lead to significant reductions in PTSS (Garoff, Kangaslampi, & Peltonen, 2018).

I should also note that the stabilization or skills training phase in all these trials was shorter than that recommended in the ISTSS guidelines (Cloitre et al., 2012). The guidelines suggest six months as a reasonable length for such an initial phase before beginning trauma-focused treatment, despite lack of empirical evidence that such a long preparative step would be beneficial. The guidelines further state that for some patients treatments of several years may be necessary. Though treatments for trauma-related disorders lasting years are indeed common in some clinical practice, especially among clinicians subscribing to van der Hart's structural dissociation of

personality theory (van der Hart, Nijenhuis, & Steele, 2005; 2006), their effects have not been empirically evaluated.

To my knowledge, no RCTs on strictly phased treatment have been carried out among children and adolescents. Lindauer (2015) notes that those stabilization interventions that do exist for traumatized children and adolescents lack empirical validation, and as long as the child or adolescent is generally capable of talking about their experiences, there is no basis for postponing trauma-focused treatment. However, many trauma-focused CBT treatments do include some elements or modules that do not focus on the trauma directly. This includes psychoeducation as during the first meeting in NET (Schauer et al., 2011) and skills training and relaxation, as is the case typically during the first four sessions in TF-CBT (Cohen et al., 2017). TF-CBT has even been characterized as phase-based treatment (Cohen & Mannarino, 2015), although even the first sessions can feature trauma-focused elements such as cognitive restructuring. In NET, which is specifically designed for those exposed to repeated trauma, exposure treatment begins at the third meeting at the latest and it is emphasized that postponing exposure is unhelpful and may even contribute to avoidance (Schauer et al., 2011).

Reviews such as those by Morina et al. (2016) and Leenarts et al. (2013) have included many studies with children and adolescents exposed to complex trauma and found trauma-focused CBT to be effective for them as well. Further, Sachser et al. (2017) specifically found that children and adolescents with a CPTSD symptom profile in the sense of the *ICD-11* benefitted equally from TF-CBT as children with regular PTSD, experiencing medium to large reductions in PTSS. Symptoms thought to be specific to CPTSD, emotion regulation difficulties, negative self-concept, and interpersonal problems, also reduced during TF-CBT. The existing NET trials (Catani et al., 2009; Ertl et al.; 2011 Ruf et al., 2010; Schaal et al, 2009) also demonstrate that exposure treatment with little non-trauma-focused preparation, skills training, or stabilization may be safely and effectively carried out among war-affected children and adolescents. Notwithstanding the debate on the clinical utility of the category of CPTSD, it appears that, as with adults (De Jongh et al., 2016), straightforward trauma-focused treatments can be safely and effectively used with children for whom such a diagnosis might fit, too.

4 MECHANISMS OF CHANGE

Psychological treatment of PTSS works, but a significant minority of patients show no improvement or continue to suffer from some level of symptoms after treatment. Clearly, there is still much to be done in improving the efficacy of treatments. Simultaneously, several different treatments show roughly equivalent average effects, but we do not know for whom or under what circumstances each particular therapy might be especially effective. We often also have little idea as to how to track progress during treatment, besides simple symptom improvement. Understanding the mechanisms of change by which psychological treatments for PTSS achieve their beneficial effects could be key to solving these problems.

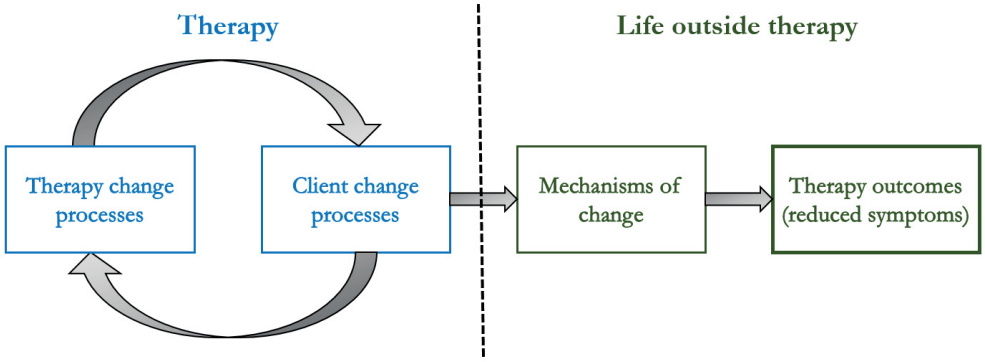

Figure 3. Change processes within therapy affect mechanisms of change outside therapy, which in turn lead to therapy outcomes. Schematic presentation and division of elements based on Doss (2004).

4.1 Processes and elements of change in psychological treatment

Different authors have proposed and used various nomenclature for studying change in therapy and the mechanisms by which therapeutic interventions have their effects (Doss, 2004; Kraemer, Wilson, Fairburn, & Agras, 2002; Kazdin, 2007; 2009; Zalta et al., 2015). Some confusion and disagreement exists in how different terms are

used. Clear definitions are essential. They may also help bridge the historical divide between deep process-oriented psychotherapy research with its rather disappointing findings (e.g., Stiles & Shapiro, 1994) and the arguably somewhat simplistic purely outcome-oriented research in the RCT tradition. I base my distinctions on Doss's (2004) framework of change in psychotherapy, presented in Figure 3.

This dissertation focuses exclusively on *mechanisms of change*. By this term I mean such change mechanisms that Doss (2004) defined as "intermediate changes in client characteristics or skills, not under direct therapist control, that are expected to lead to improvements in the ultimate outcomes of therapy" and "that have generalized into the client's life" (pp. 369–370). In Figure 3, above, these mechanisms of change are accordingly placed outside the confines of the therapy sessions, as a link between what happens in therapy and final outcomes, here, reduction in symptoms. Doss (2004) set mechanisms of change clearly apart from *therapy change processes*, i.e., the techniques, interventions, utterances, directives or other so-called active ingredients used by the therapist during sessions and *client change processes*, client actions or experiences during the treatment sessions as a result of the therapy change processes. Interaction between these processes is the fundamental content of therapy sessions, and they are accordingly placed inside it in Figure 3. This distinction holds importance, as some previous research has equated therapy change processes and mechanisms of change and overlooked the very real possibility that different therapy change processes, or treatment ingredients, may lead to changes in the same mechanisms of change. For example, even though two treatments may both lead to change in the same mechanism of change, their effects are not necessarily due to nonspecific or general factors, but may be due to very different, treatment-specific therapy change processes (Zalta, 2015).

Unraveling how beneficial change is achieved in psychological treatment must clearly involve a more comprehensive multi-level research program than simply describing and corroborating mechanisms of change (Kazdin, 2007; Tryon, 2018). Doss (2004) argued that the study of mechanisms of change would be a reasonable second stage in understanding change in treatment, after determining overall effectiveness in the first stage, but before trying to disentangle all the exact characteristics of therapy during treatment sessions and their effects on different mechanisms of change. I would maintain that in the case of change in treatments for PTSS, our current understanding is beginning to reach this second stage. Accordingly, research at the level of mechanisms of change could be most fruitful.

There are indeed a number of reasons why we should care about, research, and identify mechanisms of change in psychological treatments. Kazdin (2007) set out six such reasons, and others have expanded on several of them.

First, identifying common mechanisms of change that many effective treatments work by can bring parsimony and clarity to the plethora of different psychotherapies and interventions currently in use. This has practical implications. If several treatments or several treatment modules target the same mechanisms, combining them is not likely to yield additional impact. On the other hand, if we are able to identify a new or distinct mechanism, we could target it in a new type of treatment or treatment module, which may result in better outcomes compared with an older treatment not targeting this additional mechanism (Doss, 2004). In some cases we might even uncover incompatible or mutually opposed mechanisms, e.g., in combinations of pharmacotherapy and psychotherapy (Kraemer et al., 2002).

Second, as therapies often lead to a number of outcomes beyond reducing symptoms, such as changes in social life, physical health, or quality of life, uncovering mechanisms of therapies can help us understand the connections between what happens in treatment and this diversity of outcomes. Third, research on mechanisms can assist us in optimizing treatments. As we gain insight into what is crucial to treatment and why, we know what to focus on in treatment and what critical processes our treatment strategies should especially target and aim to trigger. This should result in more potent and efficient forms of therapy (Kraemer et al., 2002). Fourth and relatedly, understanding how treatments operate helps us translate research into real-life clinical practice and ensure the generalizability of their effects without diluting essential change processes. Being able to show in a convincing and evidence-based manner how our treatments work may also assist us in effectively disseminating interventions to clinicians and persuading them to adopt them (Doss, 2004; Tryon, 2005). This was also an important motivating idea for our research in usual care conditions in Study IV.

Fifth, by uncovering mechanisms that account for treatment outcome, we may also recognize moderators of treatment effectiveness, such as potential patients' pretreatment status in a psychological process that we aim to target as a mechanism of change. This can help us predict who might benefit from a particular treatment or select between alternative treatments targeting different mechanisms. Finally, some mechanisms of change identified to function in psychological treatment may have relevance for our understanding of people's functioning and well-being beyond therapy in everyday life or natural recovery.

In addition to these rather practical concerns, the study of mechanisms of change in the treatment of particular disorders can advance our understanding of the nature of these disorders. If we are able to affect a disorder through a particular mechanism, it is likely that this mechanism has a prominent role in maintenance of the disorder (Kraemer et al., 2002). On the other hand, if we note great improvement in a disorder but no change in a mechanism predicted to be central to it by some theory, our confidence in that theory may be seriously weakened. Thus, analyses of mechanisms of change also provide for good tests of theory.

4.2 Studying mechanisms of change

In empirical research, we typically study mechanisms of change with mediation analyses, most appropriately in the context of randomized, controlled trials. Mediators are any intervening variables that we can statistically demonstrate to account for some of the relationship between an independent and dependent variable, in this case between treatment and reduction in PTSS. It is important to stress that while mediators may represent mechanisms of change, not all mediators necessarily do (Kazdin, 2007; Kraemer et al., 2002; Tryon, 2018). The study of mediators serving as proxies for them is still a sensible first step or basic requirement for understanding mechanisms of change (Kazdin, 2009; Tryon, 2018).

A number of statistical techniques exist for demonstrating the mediating role of a variable in the effects of a treatment. Typical approaches in psychological research combine regression or structural equation model estimates of a) the relationship between treatment and mediator and b) the relationship between mediator and outcome, so that an overall estimate of the indirect effect of the treatment on the outcome via the mediator is established (Baron & Kenny, 1986; Kraemer et al., 2002; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). The typical approaches to mediation in psychology have a range of challenges and involve assumptions that are unlikely to be satisfied in many situations, which I expound on in the Discussion in Section 9.6 (Bullock, Green, & Ha, 2010).

Besides observing that it mediates treatment effects on outcomes, Kazdin (2007) provided a set of criteria for claiming robust evidence for the role of a mechanism of change in the effects of an intervention. 1) Strong association between intervention and mechanism, and mechanism and outcome. 2) Demonstration of specificity of a mechanism in that a particular construct accounts for therapeutic change, while (many) others do not. 3) Consistency in terms of replicating our

findings on a mechanism across different studies, conditions and types of samples. 4) Experimental manipulation of the mechanism as providing the most solid evidence. 5) Establishing a timeline in that mechanisms change before outcomes do. 6) Demonstrating a dose gradient in responses so that the more a mechanism is activated, the greater the change in the outcome. 7) Plausibility in that a proposed mechanism makes sense in the context of our theoretical thinking and current knowledge base.

Kazdin (2007) and others have particularly emphasized the fifth and seventh criteria and they deserve further discussion. A crucial condition indeed for claiming a mechanistic role is establishing the temporal sequence of changes, i.e., that changes in the mechanism take place before changes in the outcome and lead to them, not vice versa (Johansson & Høglend, 2007; Pek & Hoyle, 2016). Correlational evidence about concurrent changes in mechanisms and outcomes being associated with each other can hint at a mechanism in action, but is not enough to make claims about causal effects. Changes in the proposed mechanism might simply be alternative indicators of success in treatment or correlates or side effects of symptom reduction (Zalta, 2015). Even if the mechanism as such is valid and real, cross-sectional analyses may be misleading and unpredictably biased (Maxwell & Cole, 2007). All this means that to establish a timeline we should assess changes in mechanisms, at a minimum, once before assessing outcomes. Preferably, we should repeat assessments several times during and after treatment or on a session-by-session basis.

That a proposed mechanism makes theoretical sense is also crucial. Ad hoc investigations of a great variety of possible mediators and paths risks spurious findings and confusing rather than clarifying our understanding of change processes. The selection of potential mechanisms to be studied can be based on several sources, including theory on basic psychological processes, existing empirical findings on risk factors and predictors of psychopathology, wide-ranging or specific theories of psychopathology, or the rationales and clinical models of the treatments being studied (Doss, 2004; Kazdin, 2007). Surveys of clinicians or patients might be another source for putative mechanisms. In the ideal case, we would test predictions clinical models make about relevant mechanisms in empirical trials and then refine the models based on our findings. We should keep in mind the possibility, however, that a theory might correctly explain or predict intervention effects, but incorrectly explain a disorder's etiology (Tryon, 2005).

Relatedly, mechanisms must be both separate enough from ultimate outcomes, i.e., not too confounded with them, and simultaneously not simply part of the definition of the treatment and thus collinear with it (Kraemer et al., 2002). Here, we

must be clear about how we define our outcomes. In this dissertation, I mainly deal with aggregate measures of total PTSS. With such an outcome, it may be, e.g., trivial to demonstrate that a treatment's effects on intrusive symptoms at posttreatment mediate effects on total PTSS at follow-up, as intrusive symptoms are a core part of PTSS. However, such analyses tell us little about how the treatment lead to alleviation of symptoms in the first place, so change in intrusive symptoms cannot be considered a mechanism of change. More detailed analyses, e.g., at the level of individual symptoms as in network analyses (Fried et al., 2018), of the order and dynamics of symptom alleviation and spread of intervention effects may certainly be informative, but are beyond my focus here. As an example for collinearity with treatment, if an intervention were to contain guided nature walks as part of the protocol, it would be inappropriate to consider the associated increased time spent in nature as a mechanism of change. Something like increased connection with nature could be a potential mechanism of change, however.

Operationalizing mechanisms of change also provides some particular challenges (Doss, 2004). As we are dealing with change, measures of mechanisms of change must not contain historical items but should refer to factors that can in fact change over the course of therapy. Measures should also be amenable to frequent repeated assessments, and contain an adequate range of items to account for the entire course of treatment.

Some researchers have argued that it only makes sense to attempt to find mechanisms of change when we have first shown a treatment to lead to effects on the outcome (Doss, 2004; Kazdin, 2007). However, overall change in the outcome is not necessary for a significant indirect effect via a mediator to exist, as such positive indirect effects might be counteracted by another effect in the opposite direction for all or some subgroup of participants. We can extend this thinking to mechanisms of change as well (Kraemer et al., 2002). Though there may be no overall average benefit, we may identify pathways to effectiveness via some mechanisms that are counteracted by other effects in this particular treatment or sample, but could potentially be successfully exploited in a different intervention. This was part of our rationale for studying the mechanisms of change of TRT in Study II, despite its limited effectiveness in that particular sample. Still, it probably makes most sense to focus our studies on mechanisms of change generally to treatments with some evidence base.

Mechanisms of change are typically studied within the context of RCTs.. So far, this has often meant secondary analyses and afterthoughts, but increasingly plans for analysis of mechanisms are also being included in preregistered protocols of trials,

as we did for Study IV. Still, comprehensive understanding of mechanisms of change is not possible based on a single study. Thus, systematic reviews and meta-analyses such as our Study I may be particularly well suited for bringing together findings on mechanisms (Bullock et al., 2010; Kazdin, 2007).

4.3 Mechanisms of change in treating posttraumatic stress symptoms

Theories and models of PTSD detailed above in Section 2.4 may be useful guides in the search for relevant mechanisms of change in treating PTSS. There are both similarities and some differences in the possible mechanisms of change the theories predict would be crucial to reducing symptoms.

EPT suggests that the pathological fear structures typical to PTSD are maintained due to a reciprocal relation between cognitive and behavioral avoidance and overly negative, inflexible and inaccurate cognitions about the self and the world (Foa & Kozak, 1986; Foa et al., 2006). Avoidance keeps the trauma survivor from receiving information that would disconfirm their beliefs about the world being totally unpredictable and dangerous and themselves weak and incompetent, while the cognitions in turn reinforce avoidant behavior and thought suppression. According to EPT, modifying these inaccurate trauma-affected perceptions about the self, others, and the world, here termed negative posttraumatic cognitions (PTCs), could be the key to reducing symptoms (Zalta, 2015).

Early formulations of EPT also suggested that improved organization of the traumatic memory, as evidenced in reduced fragmentation and improved coherence of trauma narratives, would be associated with both natural recovery and successful treatment. However, in later writing on EPT (Foa et al., 2006; Foa & McLean, 2016), the issue of narrative change is not much emphasized. Indeed, Foa et al. (2006) suggest that improved organization of trauma narratives might be more of a consequence of successful emotional processing than a mechanism through which emotional processing occurs.

Some authors have interpreted EPT to argue that habituation to memories of the trauma, that is, reduced fear in the presence of reminders or stimuli related to it, would be an additional crucial mechanism in PTSS reduction (Bluett, Zoellner, & Feeny, 2014; Cooper, Clifton, & Feeny, 2017; Gallagher & Resick, 2012). However, I would agree with Zalta's (2015) suggestion that the evidence points to habituation being more of an indicator that emotional processing is indeed occurring and may

assist in it by providing corrective information, but is not a mechanism, per se. It also does not fully fit the above definition of a mechanism of change.

In the cognitive model of Ehlers and Clark (2000), a sense of continued, current threat is maintained by 1) overly negative appraisals of the trauma and its sequelae, or negative PTCs, 2) disturbances in autobiographical memory, with lack of coherence, elaboration, and context in declarative trauma memories on the one hand and strongly perceptually primed associative memories on the other hand, and 3) cognitive and behavioral strategies that prevent change in 1) and 2). The negative PTCs the cognitive model suggests to be most central in relation to the traumatic event would include exaggerated probabilities of future harms and catastrophes and lack of capability to endure such harms. In addition, PTSS and other changes resulting from the trauma might be interpreted as threats to physical and mental well-being or evidence of permanent damage or irreversible negative change. These negative PTCs bias recall of the traumatic events such that only information consistent with these appraisals is retrieved. Trauma survivors then use strategies such as thought suppression, safety behaviors, avoidance of reminders, and rumination to keep the sense of threat at bay. Thus, the cognitive model suggests modification of PTCs that keep up a sense of current threat, contextualizing and integration of the traumatic memory into autobiographical memory, and reduced use of dysfunctional coping strategies as possible mechanisms of change to reduce PTSS.

Dual representation models (Brewin et al., 1996; 2010; Metcalfe & Jacobs, 1998), likewise suggest that an essential mechanism of change in recovering from PTSS would be the contextualization and integration of more sensory based memories (hot memories, SAMs, S-reps) into declarative autobiographical memory (cool memories, VAMs, C-reps). In dual representation theory (Brewin et al., 1996; 2010) adequate completion of emotional processing could be achieved by this integration of the details of the S-rep into the C-rep and the editing of the C-rep to correspond to the realities of the experience, strengthening the association between the two representations. As a result, both conscious top-down retrieval and suppression or modulation of the S-rep, would become possible, as required, and the unwanted activation of the S-rep would decrease. A different interpretation proposed later by Brewin (2018) is that a new, alternative C-rep might be created that could inhibit the sensory representation.

The relevance of negative PTCs is less clear in dual representation theory. Editing the C-reps to accommodate trauma-related information could be viewed in terms of cognitive change. However, according to Brewin (2018), it is reducing the impact of

intrusive memories that would lead to restoring more positive appraisals, suggesting the primary importance of affecting memories.

Three possible mechanisms of change emerge from the predictions of the cognitive model, EPT, and dual representation theory: changes in overly negative PTCs, improvements in problematic qualities, integration, and coherence of traumatic memories, and reduction in the use of maladaptive, avoidant coping strategies and behaviors. EPT places particular importance and primacy on the PTCs, while dual representation theory suggest changes in memories to be key.

In the following sections, I present empirical evidence on whether negative PTCs and qualities of traumatic memories, which we examine in Studies II and IV, are indeed linked to PTSS, as these theories suggest. I then briefly introduce similar evidence on links with PTSS for maladaptive coping strategies as well as biases in attention and emotion regulation problems, which some empirical work suggests as other possible mechanisms. Evidence on whether it is possible to reduce PTSS through changes in these processes, that is, whether they indeed act as mechanisms of change that treatments could work through, is reviewed in Study I and discussed in Section 9.1.

4.3.1 Negative posttraumatic cognitions

Of these three possible mechanisms, the role of negative PTCs in the development and maintenance of PTSS has certainly seen the most empirical study. Adult trauma survivors with PTSD have more overly negative PTCs about the world and themselves than survivors without PTSD and those with no trauma exposure (Cox, Resnick, & Kilpatrick, 2014; Foa, Ehlers, Clark, Tolin, & Orsillo, 1999). Interpersonal and repeated trauma as well as female gender are especially associated with negative PTCs (Cox et al., 2014). Higher rates of negative PTCs may help explain why PTSD is more common among women and girls. Among adults, negative PTCs also predict both concurrent and later PTSS (e.g., Hansen, Armour, Wittman, Elklit, & Shevlin, 2014; Karl, Rabe, Zöllner, Maercker, & Stopa, 2009) and appear to mediate between early and later PTSS (Carper et al., 2015).

Negative PTCs appear to be a key factor in maintenance of PTSS among children and adolescents, too (Dalgleish, Meiser-Stedman, & Smith, 2005; Hiller et al., 2019; Meiser-Stedman et al., 2019). A meta-analysis confirmed the strong relationship between PTCs and PTSS among children and adolescents, arriving at a large effect size based on eleven studies (Mitchell, Brennan, Curran, Hanna, & Dyer, 2017).

However, in contrast to Carper et al. (2015) and similar preliminary suggestions found by Meiser-Stedman, Dalgleish, Glucksman, Yule, and Smith (2009) among children, Palosaari, Punamäki, Diab, & Qouta (2013) did not find PTCs to mediate between early and later PTSS among Palestinian school-aged children affected by war. Earlier levels of PTCs did still predict later levels of PTSS in this study, employing the same sample as Study II. Also in the same sample, Palosaari, Punamäki, Peltonen, Diab, and Qouta (2015) found negative effects of social risk factors on the children's PTSS to be mediated by effects on PTCs. Meanwhile, Münzer, Ganser, and Goldbeck (2017) reported among maltreated children and adolescents that the protective effects of good social support on PTSS might be also be mediated by (fewer) negative PTCs. Thus, while the role of PTCs as a link between early and later symptoms is unclear among children, PTCs may be an intermediate point where risk factors turn into PTSS for children affected by violence, as well (Palosaari, 2016). It thus makes sense to assume that they might then also be a potential mechanism of change in affecting PTSS. Some evidence further points to the relevance of negative PTCs for wider internalizing psychopathology beyond PTSD among children (Hiller et al., 2019; Liu & Chen, 2015). Though beyond the scope of this dissertation, these findings suggest that targeting negative PTCs in treatment of PTSS could also lead to alleviation of comorbid problems such as anxiety and depression.

I should note that change in cognitions can refer to an enormous range of processes (Cooper et al., 2017). I use the term *negative PTCs* here to refer to beliefs and appraisals about or affected by the trauma that are at least somewhat accessible to the trauma survivor themselves. Thus, the term does not encompass deeper-level cognitive processes such as biased attention, rumination or other cognitive tendencies and strategies, nor deficits and changes in memory, learning or cognitive skills.

What sort of cognitions exactly would be central to PTSD and could be targeted in treatment? EPT suggests two core meaning elements in PTSD fear structures: 1) that the world is completely dangerous and 2) that the self is totally incompetent (Foa et al., 2006). A corresponding division of maladaptive PTCs was indeed found by Foa et al. (1999) in a principal components analysis of the Post-Traumatic Cognitions Inventory, a popular adult measure for PTCs, where three factors emerged: negative PTCs about the self, negative PTCs about the world, and self-blame. Among children, developers of the Children's Post-Traumatic Cognitions Inventory (CPTCI) found that negative PTCs among children could be divided into those relating to personal integrity and those relating to physical threat, or more

expressively *permanent and disturbing change* and being a *fragile person in a scary world* (Meiser-Stedman, Smith et al., 2009). These are the cognitions we also focused on in Studies II and IV. Notably, questions about self-blame are not included in the CPTCI.

In addition to the challenge of pinpointing exactly what sort of PTCs we are studying, with the introduction of some cognitive alterations as core symptoms in the *DSM-5* description of PTSD (APA, 2013), the issue of the mechanism becoming confounded with the outcome is also a particular concern in the case of PTCs (Cooper et al., 2017). However, nearly all studies included in our review in Study I and our own empirical studies still used *DSM-IV* based criteria for PTSS, which do not include such cognitions.

4.3.2 Problematic qualities of traumatic memories

The relationship between problematic, i.e., overly sensory, fragmented, incoherent, or disorganized, qualities of traumatic memories and PTSS has been studied in two traditions. In the first one, trauma survivors provide, in writing or orally, accounts or narratives of their traumatic experience, which researchers or independent judges then code and rate according to pre-defined criteria. In the second approach, trauma survivors answer questions about the quality of their memories as self-report.

Findings in the first tradition on features of the trauma narrative and PTSD symptomatology have been mixed and open to differing interpretations. Some studies have linked PTSD with more experimenter-rated incoherence or disorganization in trauma narratives among adults (Halligan, Michael, Clark, & Ehlers, 2003; Jelinek, Randjbar, Seifert, Kellner, & Moritz, 2009; Jones, Harvey, & Brewin, 2007). Still, differences in ratings in many studies have been small, and ratings of traumatic memories on average quite coherent and organized for both those with and without PTSD. Others have been totally unable to replicate these findings (e.g., Berntsen, Willert, & Rubin, 2003; Rubin, Deffler et al., 2016). Rubin, Deffler et al. (2016), employing a very wide variety of potential measures, found trauma memories to be at least as coherent as other important, positive memories, and no difference between people with and without PTSD in memory coherence.

Few studies on qualities of trauma narratives and their links with PTSS exist among children. Kenardy et al. (2007) found some preliminary evidence of association between temporal disorganization of trauma narratives and PTSS among children and adolescents exposed to physical injury trauma. Salmond et al. (2011),

studying trauma narratives of children with acute stress disorder (ASD) due to a single traumatic event, also found them to be more disorganized than those of controls without ASD. Level of narrative disorganization also predicted severity of stress symptoms. In contrast, Bray, Brewer, Cameron, and Nixon (2018), studying 7–17-year-old survivors of recent traumatic injury, found high PTSS to associate with more detail in their trauma narratives compared with memory of a positive event and no difference in narrative cohesion between those with high or low levels of PTSS or between narratives of trauma and positive events. In even more contrasting findings, O'Kearney, Speyer, and Kenardy (2007) found among 7–16-year-old children after traumatic injury that higher PTSS were associated with better conceptual understanding and quality of trauma narratives in terms of lexical structure and cohesion, as well as less sensory and perceptual impressions. Finally, in a prospective study among child and adolescent survivors of single-incident trauma, McKinnon, Brewer, Meiser-Stedman, and Nixon (2017) found temporal disorganization of trauma narratives to predict concurrent and later PTSS, but only when self-report quality of traumatic memories was not accounted for.

Summing the evidence, Brewin (2014) argued that at least studies using independent judges as raters have indeed found the trauma narratives of those with PTSD to be more disorganized than their non-trauma narratives and trauma narratives of those without PTSD. However, Rubin, Deffler et al. (2016) reviewing mostly the same evidence came to quite different conclusions and argued that there really is no evidence that trauma memories of people with PTSD are less coherent. What might explain these incongruent and even contradictory findings and interpretations? First, coherence is certainly a difficult concept to operationalize and measure, and different studies have used different conceptualizations. Beyond this, another alternative presented by Brewin (2016; 2018) is that fragmentation or disorganization do exist in traumatic memories, but only at the most upsetting moments or hot spots. Thus, they would only appear when trauma survivors focus on these moments in detail, not when they describe their experiences more generally.

In the second tradition of self-reports about the quality of traumatic memories, which might also be characterized as meta-memory or perception of memory quality (Bedard-Gilligan & Zoellner, 2012; McKinnon et al., 2017), some studies are available among children and adolescents. Stallard and Smith (2007) did not find self-reported memory quality to significantly explain variance in PTSS beyond the effect of negative PTCs, among 7–17-year old survivors of traffic accidents. However, just two individual items were used to assess memory quality, and one of them, *feeling confused or muddled during the accident*, was bivariately associated with PTSS.

Using the more comprehensive Trauma Memory Quality Questionnaire (TMQQ; Meiser-Stedman, Smith, Yule, & Dalgleish, 2007), also employed in Study IV, Meiser-Stedman et al. (2007) found self-reported memory quality to mediate the relationship between trauma severity and symptoms of ASD for survivors of single-incident trauma. In another later study of child and adolescent survivors of single-incident trauma, Meiser-Stedman et al. (2019) found memory quality at two weeks post-trauma to associate with level of PTSS and PTSD diagnosis two months after the trauma. However, controlling for other factors such as negative PTCs, coping styles, and dissociation, memory quality did not predict later PTSS. McKinnon, Nixon, and Brewer (2008) found self-reported memory quality assessed with the TMQQ to mediate relationships between data-driven processing and fear during the trauma and later intrusive symptoms, though not avoidance or arousal symptoms, among 7–16-year-old children exposed to single-incident trauma. McKinnon et al. (2017) also found in child survivors of injury that self-reported trauma memory quality predicted PTSS both cross-sectionally and longitudinally, and accounted for variance initially explained by narrative characteristics. Improvement in self-reported memory quality also predicted reduction in PTSS, suggesting a role in (natural) recovery. This interpretation is supported by the findings of Hiller et al. (2019) that change in self-reported memory quality from one to seven months post-trauma associated with change in PTSS over the same period among school-aged survivors of single-incident trauma.

As these studies only assessed trauma memories, their findings may reflect more general memory disturbance or perception of memory problems in PTSD and not quality of traumatic memory per se. In their study of recent child survivors of single-incident trauma, Salmond et al. (2011) found those with ASD to report their memories overall to be more sensory and fragmented, and all children to report trauma memories as more sensory and fragmented than other memories. However, there was no interaction between ASD status and type of memory as would be expected if quality of trauma memory was uniquely linked to ASD symptoms, and self-reported quality of traumatic memory did not associate with symptom severity. In contrast, Bray et al. (2018) found child survivors of injury trauma with higher PTSS to report more sensory and less organized memories of their trauma compared with a positive event and with those with low PTSS.

In sum, findings on self-reported memory quality and its relation to PTSS among children and adolescents are somewhat mixed, but do overall suggest a link. In particular, the prospective studies by McKinnon et al. (2017) and Hiller et al. (2019) suggest that changes in self-reported memory quality might also be important for

changes in PTSS. Such findings and the significant emphasis the cognitive model of Ehlers and Clark (2000) and dual representation theory (Brewin et al., 1996) place on problematic qualities of traumatic memories as integral to the maintenance of PTSS motivate us to study changes in memories as a possible mechanism of change. Notably, however, all the above research concerns children and adolescents with single-incident trauma. The relevance of problematic qualities of trauma memories to PTSS among multiply traumatized children remains unclear, which is where Study IV particularly aims to contribute.

4.3.3 Other potential mechanisms of change

Improvements in maladaptive coping strategies are another potential mechanism especially the cognitive model of Ehlers and Clark (2000) suggests might be important to treating PTSS. In empirical research, problematic coping strategies that have the strongest links with PTSS include rumination, thought suppression and experiential avoidance (Seligowski, Lee, Bardeen, & Orcutt, 2015; Szabo, Warnecke, Newton, & Valentine, 2017). Among children, too, thought suppression and rumination (Ehlers, Mayou, & Bryant, 2003; Hiller et al., 2019; Meiser-Stedman et al., 2014; 2019; Simon, Feiring, & McElroy, 2010) have indeed been linked to worse PTSS.

Based mostly on empirical findings on trauma survivors with PTSD, other potential mechanisms of change in treatment of PTSS could include improved emotion regulation and reductions in attentional bias. Large effect sizes have been found for links between emotional dysregulation and PTSD (Seligowski et al., 2015) and emotion dysregulation in the aftermath of trauma may hinder recovery from PTSS (Bardeen, Kumpula, & Orcutt, 2013; Meiser-Stedman et al., 2019). Conversely, more positive or adaptive emotion regulation strategies such as acceptance, cognitive reappraisal, and problem solving have been linked to lower PTSS severity (McLean & Foa, 2017). Emotion regulation difficulties are also common among youth exposed to interpersonal trauma (Perkonigg et al., 2015) and war (Betancourt et al., 2014), and a recent meta-analysis confirmed the strong association between emotion regulation difficulties and PTSD among children and adolescents (Villalta, Smith, Hickin, & Stingaris, 2018). Improved emotion regulation could thus lead to amelioration of PTSS. Alternatively, reduced sensitivity to and distress associated with trauma reminders and improvements in negative PTCs and thereby cognitively mediated emotions may lead to better emotion regulation (De Jongh et al., 2016).

Despite much research, findings are somewhat conflicting as to whether there is a bias towards threat-related or in general emotional stimuli, a bias away from threat, or a combination of both, among trauma survivors with PTSD (Zinchenko et al., 2017). Findings among children and adolescents are also contradictory as to what sort of bias tends to dominate (Dalgleish, Moradi, Taghavi, Neshat-Doost, and Yule, 2001; Pine et al., 2005), and whether attention biases are really unique to those with significant PTSS (Masten et al., 2008; Zhang, Kong, Han, Najam, & Chen, 2014). Whatever their exact nature, attentional biases relevant to PTSD might form an additional mechanism of change to target. Instead of targeting conscious psychological processes in order to reduce biased attention, perhaps we could directly modify biases in attention (Bar-Haim, 2010), allowing the trauma survivor to receive more corrective information and thus heal from PTSS.

4.4 Previous reviews of evidence for mechanisms of change

Over the last ten years or so, some empirical studies have begun to examine the mechanisms of change actually involved in treating PTSS by psychological methods. A few previous reviews have examined the empirical evidence for particular or any mechanisms of change involved in particular or any cognitive-behavioral treatments for PTSS.

Zalta (2015) listed psychological mechanisms developers of PE, CPT, and cognitive therapy for PTSD (CT-PTSD; Ehlers, Clark, Hackmann, McManus, & Fennell, 2005) suggest to account for their treatments' effects and recent empirical evidence on these mechanisms. She found one study for PE and CT-PTSD each providing evidence for change in negative PTCs as a mechanism of change in PTSS reduction. One study further examined changes in hope as a potential mechanism of change in group CPT with unclear results, and one suggested improvements in hopelessness may be a more pertinent mechanism in CPT than PE, although both treatments led to similar outcomes in terms of PTSS. Zalta (2015) suggested more detailed information on the types of cognitions different treatments target, such as a belief that one cannot handle facing the trauma in PE and hopelessness in CPT, could make it possible to tailor and select treatments according to each trauma survivor's central problematic PTCs.

Sripada, Rauch, and Liberzon (2016) examined evidence from 2013–2016 on emotional engagement, facets of extinction and inhibitory learning, contextualization, distress tolerance, and negative PTCs as mechanisms of

treatments of PTSS. They found ample recent evidence for changes in negative PTCs as a mechanism of change in CPT and PE and some evidence for the role of between-session habituation and fear reduction, which do not fit my definition of a mechanism of change, in PE, but little to no evidence for the other suggested mechanisms.

Cooper et al. (2017) reviewed evidence on six putative mechanisms and mediators of PE in particular: emotional engagement, within-session habituation, between-session habituation, reorganization of the trauma narrative, trauma-related belief change, and inhibitory learning. From the perspective I take in this dissertation, Cooper et al. (2017) defined mechanisms of change imprecisely and confused treatment ingredients and mechanisms of change to some extent. Nevertheless, the review found strong evidence for trauma-related belief change (PTCs) as a mechanism of PE from eight studies, but little evidence for narrative reorganization or inhibitory learning as mechanisms. Findings on the roles of emotional engagement and within-session habituation in the effects of PE were inconsistent. Between-session habituation, however, does seem to be linked to superior outcomes in PE, though the effect sizes of the links are generally modest.

All these reviews were restricted to trauma-focused CBT treatments. Mechanisms of change have rarely been studied in more general group psychosocial interventions, and no reviews on the topic exist. In notable exceptions, Tol et al. (2010; 2012; 2014) examined improvements in hope, coping, and different types of social support as possible mechanisms mediating the effects of their classroom-based intervention on PTSS among Indonesian, Sri Lankan, and Burundian schoolchildren affected by war and political violence. In Indonesia, the intervention did lead to increased hope and more use of positive coping methods, but such improvements did not account for intervention effects (Tol et al., 2010). In Sri Lanka, expected effects on coping strategies were not observed (Tol et al., 2012). There were no overall effects on hope in Burundi (Tol et al., 2014). The overall rather limited effects on PTSS and other mental health problems may explain this lack of findings, but inability to effect change in the hypothesized mechanisms may also explain why the intervention was not particularly effective.

4.5 Gaps in current knowledge and contribution of the present studies

While brief and partial reviews of the topic exist, no systematic reviews have taken account of all the evidence currently available for mechanisms of change involved in the treatment of PTSS by psychological methods. The existing reviews have also limited themselves to particular treatments, instead of focusing on the phenomenon of mechanisms of change themselves. Crucially, none of them has included studies among children and adolescents. Thus, an overview of this emerging and still somewhat disorganized field of research is lacking, which limits our understanding of the range of mechanisms that a) have been proposed and b) have actually been studied in controlled empirical trials. Study I aims to fill this gap by providing a comprehensive, systematic synthesis of the existing evidence.

The psychological mechanisms of change involved in the effects of NET on PTSS have not been previously examined at all. Effects of TRT on negative PTCs have never been examined, either. Thus, Studies II and IV on changes in negative PTCs and traumatic memories as mechanisms of change in these interventions provide novel evidence on whether TRT and NET might work through similar mechanisms as treatments such as PE, TF-CBT and CT-PTSD, on which some studies are available.

For TRT in Study II, uncovering whether it was able to affect the posttraumatic cognitions of war-affected children and whether such effects acted as mechanisms of change in the intervention's effects on PTSS could help us understand the mixed findings on the effectiveness of TRT and similar psychosocial group interventions in reducing PTSS among children affected by war or conflict. Looking at changes in the children's posttraumatic cognitions over the course of the intervention in more detail, we might further be able to identify particular groups of children for whom negative posttraumatic cognitions are especially pronounced or resistant to change, as well as important moderators that affect whether change in negative PTCs and through that, theoretically, in PTSS, is possible.

For NET in Study IV, examining the role of changes in negative PTCs and in quality of traumatic memories in PTSS reduction allows us to begin to pinpoint the possible mechanisms of change responsible for this evidence-based treatment's notable effects. Simultaneously, examining whether changes in these possible mechanisms also take place during TAU provides important evidence on whether they might be general mechanisms many sorts of effective treatment work by, or

whether they are unique to trauma-focused or exposure-based treatments such as NET.

It is also crucial to examine whether findings on mechanisms of change generalize to situations of usual care (Doss, 2004). Especially for trauma-focused treatment, few studies on mechanisms have taken place in usual care or community environments. As such, a unique contribution of Studies III and IV is examining NET in a very naturalistic setting, in usual care conditions within the existing structures of the Finnish healthcare system, employing principles of pragmatic trials with minimal researcher involvement.

5 CHILDREN EXPOSED TO WAR AND VIOLENCE

Our empirical research concerns children and adolescents traumatized by experiences of war and conflict, refugeedom, or violence within the family. Over half of all children, over one billion globally, experience some form of physical violence over the course of a year (Hillis, Mercy, Amobi, & Kress, 2016). More children than ever before, 420 million, live in areas affected by war or armed conflict, including 142 million in high-intensity active conflict zones (Save the Children, 2019). Meanwhile, up to 23% of children and adolescents globally report having had experiences of violence that could constitute physical abuse (Stoltenborgh, Bakermans-Kranenburg, van IJzendoorn, & Alink, 2013).

5.1 Children in Palestine

The participants in Study II were school-aged children from North Gaza and Gaza City in the Gaza Strip in Palestine. Our study was carried out in the aftermath of the 2008–2009 Gaza War, known by the different parties as Operation Cast Lead (מִבְצָע עוֹפֶרֶת יְצוּקָה), the Battle of Al-Furqan (معركة الفرقان), or the Gaza Massacre. The war resulted in around 1,400 deaths, of which nine were Israeli soldiers and four Israeli civilians, the remainder being Gazans, including 240 police officers and hundreds of civilians (United Nations Human Rights Council [UNHRC], 2009). Of those killed, 431 were Palestinian children under the age of 18. At least 5,400 Palestinians were injured, including over 1,800 children (WHO, 2009). Around 100,000 people were newly displaced in Gaza, with half of them housed in United Nations Relief and Works Agency shelters at the start of 2009. North Gaza and Gaza City were among the areas hardest hit by the war (Abu-Rmeileh et al., 2012).

The war featured probable war crimes by Israeli forces such as deliberate attacks including the use of white phosphorus against the Al-Quds and Al-Wafa hospitals as well as the United Nations Relief and Works Agency field office sheltering hundreds of civilians, and deliberate destruction of farmland and food production facilities (UNHRC, 2009). In total, fifteen hospitals were damaged and access to healthcare severely affected (WHO, 2009). At the same time, Palestinian armed

groups also committed probable war crimes prior to and during the conflict by indiscriminately launching rockets and mortars into Southern Israel and by using civilians and civilian areas to shield themselves (UNHRC, 2009).

Most children living in Gaza in 2009 had been exposed to traumatic events, whether in connection to the war of 2008–2009, before that, or both. Qouta and El Sarraj (2004) reported that over 60% of children and adolescents 10–19 years of age living in Gaza had witnessed the injury or death of a family member and more than 80% had witnessed shooting, fighting or explosions. According to a self-report scale, close to a third suffered from severe PTSS as a result. In an intervention study carried out in 2005–2006 by Peltonen, Qouta, El Sarraj, and Punamäki (2012), around half of school-aged children in randomly selected classes suffered from probable PTSD. In the sample Study II is based on, there was likewise high exposure to war trauma with over 60% of children having witnessed violent deaths, around a quarter having been injured or hurt themselves, and more than half having feared for their life (Palosaari, Punamäki, Qouta, & Diab, 2013). As a result, around half of participating children suffered from probable PTSD (Qouta et al., 2012).

As regards the adults in Gaza, already immediately preceding the war, in 2007–2008, Canetti et al. (2010) found that slightly under a quarter of adults suffered from PTSD and slightly over a quarter from major depression. With so many of their parents suffering from serious disorders themselves even prior to the war, adequate parental support to cope with trauma-related problems was likely to be lacking for many of the children in our study in the aftermath of the war, too.

Apart from direct experiences of war, the difficult living conditions in the Gaza Strip, exacerbated by the Israeli blockade and international economic boycott since 2007, are an additional source of stress for adults and children alike. As an example, the United Nations Conference on Trade and Development (2015) noted that the three military operations against Gaza from 2007–2015 and the blockade "ravaged the already debilitated infrastructure of Gaza, shattered its productive base, left no time for meaningful reconstruction or economic recovery and impoverished the Palestinian population in Gaza" (p. 7). In a quality of life survey six months after the war, 49% of adult Gazans reported moderate or high levels of individual distress, while 88% suffered from moderate or high levels of human insecurity, 74% reported crucial needs related to livelihood and 42% to rebuilding their homes (Abu-Rmeileh et al., 2012). More than half had problems with basic needs such electricity, clean water and cooking gas. The on-going siege and the latest war were cited as primary sources of suffering by around 90% of respondents. Meanwhile in 2009, unemployment stood at around 40% (United Nations, 2017), and the war had also

exacerbated opioid abuse especially among teenage and young adult males (Progler, 2010).

The population of the Gaza Strip was around 1.5 million at the time of the study, of whom slightly more than half were under the age of 18 (Association of International Development Agencies [AIDA], 2009; WHO, 2009). With around 4,000–5,000 people / km^2, Gaza was among the most densely populated areas on the planet, with high fertility rates and overcrowding becoming serious issues. Importantly for the children in our study, the war of 2008–2009 also devastated parts of Gaza's education system with at least 280 schools or kindergartens damaged and 18 schools fully destroyed. This worsened the already existing overcrowding in schools and decline in academic achievements (AIDA, 2009).

The psychological effects of the enduring isolation and blockade of Gaza should not be under-estimated, either. Gazans were and are to a large extent prisoners in their own country, unable to go abroad except in specific circumstances after grappling with Israeli or Egyptian authorities. Most will never travel outside the 5–10 km wide strip of land.

With such high levels of PTSS among children in Gaza, the need for mental health treatment and support was and remains obvious and acute. At the same time, economic hardship, an over-stretched and repeatedly devastated healthcare sector, and lack of trained therapists mean that provision of individual trauma-focused treatment to all those that would need it appears impossible. Thus, exploring the possibility of helping children in Gaza cope with their PTSS with group-based psychosocial interventions that could be easily implemented is an important area of research with immediate practical implications. As findings on the results of such interventions in Palestine have been mixed (Barron et al., 2013; 2016; Qouta et al., 2012), understanding how and why interventions succeed or fail to affect children's PTSS is a particularly pressing concern.

5.2 Children and adolescents as refugees and asylum seekers

According to the United Nations High Commissioner for Refugees (2018), 68.5 million people were forcibly displaced due to war, conflict, or persecution as of June 2018, with 25.4 million of them registered as refugees. Over half of refugees are under 18 years of age. During 2015–2016, around 1.3 million people sought asylum in Europe yearly, down to around 580,000 in 2018 (eurostat, 2019), of whom around 30% were under 18 years of age. In 2015, Finland received 32,300 applications for

asylum, of which 24% concerned children and adolescents under 18 (Finnish Immigration Service, 2019). New applications in Finland dropped to 5,300 in 2016 and further to 2,900 in 2018.

Besides possible traumatic exposure in the country of origin, children and adolescents who flee their home country often face hardships and dangerous circumstances during their travel to a country of resettlement, which might last weeks or months (Fazel, Reed, Panter-Brick, & Stein, 2012). Separation from family and the use of professional traffickers increase risks of exposure to further trauma. After arrival, they face challenges in sociocultural adaptation and integration, as well as in the complex immigration process itself. Accordingly, child and adolescent refugees and asylum seekers suffer from high levels of PTSS (Tam, Houlihan, & Melendez-Torres, 2017). Fazel et al. (2012) found the degree of PTSS among child and adolescent refugees to be particularly associated with traumatic events experienced away from home and across the refugees' lifetime, as well as with perceived personal threat during traumatic exposure, rather than with number of pre-migration traumatic events only. They also found parental exposure to trauma and especially torture to be strongly linked to mental health problems among child and adolescent refugees. Conversely, family support and cohesion are important protective factors. Perceived acceptance versus discrimination in the host country may also contribute to fewer PTSS.

Some of the participants in our Studies III and IV were unaccompanied refugee minors, who are recognized as an especially vulnerable group. At the height of the influx of asylum seekers in 2015, out of total of 90,000 in the EU, 3,024 unaccompanied minors sought asylum in Finland, with the number decreasing to 401 in 2016 and 109 in 2018 (eurostat, 2019; Finnish Immigration Service, 2019).

Unaccompanied minors are likely to have experienced an even higher level of trauma and thus to suffer from higher rates of mental health problems compared with accompanied minor refugees or asylum seekers. For example, unaccompanied asylum-seeking children from the Balkans and the Horn of Africa in London were five to seven times more likely to report experiences of serious trauma such as murder of family or friends or being tortured compared with accompanied asylum-seeking and refugee children (Hodes, Jagdex, Chandra, & Cunniff, 2008). Over 65% of unaccompanied children self-reported levels of PTSS suggesting probable PTSD, compared with 26% of accompanied children. Less supportive living arrangements were a particular factor associated with PTSS. Similarly, Vervliet, Lammertyn, Broekaert, and Derluyn (2014) found 48% of newly arrived unaccompanied adolescents in Belgium to suffer from severe levels of PTSS and that these symptoms

did not reduce significantly overly an 18-month follow-up. Both experiencing traumatic events and current daily stressors predicted PTSS. A third of unaccompanied adolescent Afghani boys seeking asylum in the UK were found to have levels of PTSS suggesting PTSD by Bronstein, Montgomery, and Dobrowolski (2012). Again, premigration traumatic events and more independent living arrangements were associated with higher levels of sypmtoms. While piloting a group stabilization intervention in Finland, our research group found 8/11 participating unaccompanied minors to have probable PTSD (Garoff et al., 2018). In sum, Fazel et al. (2012) note that being unaccompanied on entry to the host country significantly increases the risk of psychological disorders. Despite high levels of PTSS and other mental health problems, unaccompanied minors often do not seek or receive adequate treatment, and there is general lack of evidence for effectiveness of psychological treatments among them (Mitra & Hodes, 2019)

Overall, though many refugee children and adolescents show great resilience (Hodes & Vostanis, 2018), many also suffer from severe PTSS and other mental health problems. Most longitudinal studies have shown some gradual improvement in the mental health of refugee and asylum-seeking children and adolescents over time spent in the host country (Fazel et al., 2012), but persisting high levels of PTSS are also reported (Vervliet et al., 2014; Tam et al., 2017). With such high levels of chronic PTSS, a significant minority of refugee and asylum-seeking children and adolescents will require psychological treatment. Establishing the safety, acceptability, and effectiveness of treatment approaches in this population is vital.

5.3 Physical and sexual abuse of children and adolescents in Finland

Those participants in our Studies III and IV born in Finland were suffering from PTSS due to exposure to repeated physical or sexual abuse within the family. Reliable statistics on the prevalence of these serious forms of maltreatment are somewhat hard to come by. Much of the violence against children is never reported (Gilbert et al., 2009) and thus not identifiable from police or social welfare records. Especially for older children, self-report surveys may be a more reliable source. Retrospective surveys of adults on their experiences as children have also been used.

Peltonen, Ellonen, Larsen, and Helweg-Larsen (2010), based on a large national survey, reported that 2% of girls and 1.4% of Finnish 15–16-year old adolescents had experienced severe parental physical violence such as battering, punching, or

kicking, during the preceding year. A further 10% of girls and 4% of boys had experienced milder forms of physical violence such as pushing or shoving, hair pulling, smacking or whipping. Exposure to parental violence was associated with higher levels of externalizing and internalizing symptoms.

In a study by Laaksonen et al. (2011) based on a sample of more than 10,000 participants, 5% of Finnish women and 1.3% of Finnish men 18–43 years of age reported having been sexually abused as children. 9.3% of women and 4.3% of men further reported being inappropriately sexually touched as children. Younger adults reported lower rates, suggesting that while reporting and prosecutions for child sexual abuse increased sharply between 1980–2005, its actual incidence has likely declined. Sexual abuse was associated with physical and psychological maltreatment. Growing up without one biological parent was identified as a particular risk factor for child sexual abuse. These rates of sexual abuse reported in Finland are somewhat lower than those in the U.S. (Briere & Elliott, 2003) and the Netherlands (Okur, van der Knaap, & Bogaerts, 2015), for example. Diverging definitions of sexual abuse are likely to explain some, but not all, of the difference.

6 AIMS OF THE DISSERTATION

The general aims of this dissertation were to examine psychological mechanisms of change by which psychological interventions are able to treat posttraumatic stress symptoms, especially among children and adolescents multiply traumatized by exposure to war or violence, as well as the feasibility and effectiveness of implementing narrative exposure therapy in usual care conditions among such children. To that end, the specific aims and hypotheses of the four studies included in the dissertation were

Study I: To identify all mechanisms of change that have been evaluated in controlled trials of psychological interventions for posttraumatic stress symptoms.

To describe the strength and consistency of the evidence for the role of each mechanism of change in the alleviation of posttraumatic stress symptoms by different interventions.

To provide, based on our findings, recommendations for future research on mechanisms of change in interventions for posttraumatic stress symptoms.

Study II: To examine whether taking part in a group psychosocial intervention, Teaching Recovery Techniques, improved negative posttraumatic cognitions among school-aged Palestinian children, and whether such improvements acted as a mechanism of change explaining some of the effects of the intervention on posttraumatic stress symptoms. We hypothesized that participation in TRT would lead to greater reductions in negative posttraumatic cognitions than in a waiting-list comparison group, and that the greater reduction in negative posttraumatic cognitions would mediate effects of TRT on posttraumatic stress symptoms.

To explore whether differing trajectories could be identified in the level of and change in posttraumatic cognitions among children

receiving the intervention, and whether the participants' gender, age, severity of war trauma or preintervention mental health would predict the trajectory of their cognitions.

Study III: To determine whether narrative exposure therapy could be feasibly and safely implemented within the existing Finnish healthcare system and whether there exist any particular barriers or obstacles restricting its use in everyday clinical practice.

To study whether narrative exposure therapy would reduce posttraumatic stress symptoms, depressive symptoms, and/or psychological distress or improve resilience among children and adolescents traumatized by multiple exposure to war or violence more effectively than treatment as usual currently provided by Finnish healthcare units. We hypothesized that narrative exposure therapy would reduce mental health symptoms and improve resilience more effectively than treatment as usual.

Study IV: To examine changes in negative posttraumatic cognitions and self-reported problematic qualities of traumatic memories during treatment of posttraumatic stress symptoms in a usual care environment among children and adolescents traumatized by multiple exposure to war or violence.

To determine whether there were differences in changes in such cognitions and memories between narrative exposure therapy and treatment as usual and explore whether change in such cognitions and memories would be related to reduction in posttraumatic stress symptoms. We hypothesized that narrative exposure therapy would lead to greater improvements in negative posttraumatic cognitions and quality of traumatic memories than treatment as usual.

To test whether changes in posttraumatic cognitions and/or the quality of traumatic memories acted as mechanisms of change responsible for the effectiveness of narrative exposure therapy in reducing posttraumatic stress symptoms, as compared with treatment as usual as currently provided by Finnish healthcare units. We hypothesized that changes in negative posttraumatic cognitions and the quality of traumatic memories would act as mechanisms of change explaining some of narrative exposure therapy's greater effects on posttraumatic stress symptoms.

7 MATERIALS AND METHODS

7.1 Participants and procedure

7.1.1 Study selection and procedure in Study I

As a systematic review, the sample of Study I consisted of empirical research articles identified and selected according to pre-defined criteria. Studies had to be 1) based on randomized controlled trials 2) of a psychological or cognitive intervention 3) delivered in person 4) with a primary or a secondary aim of alleviating PTSS, and include 5) a PTSS outcome specified in terms of reduction in the severity or frequency of symptoms, and 6) an explicit examination of the role of a hypothesized mechanism of change in the effects of the intervention on PTSS. Studies also had to be 7) prospective, 8) with at least two points of measurement (pre-post), and 9) published in a peer-reviewed academic journal. We placed no restrictions regarding year of publication. We excluded studies on tele-health or e-medicine, on non-psychological interventions, and in populations with traumatic brain injury.

The electronic databases *MEDLINE*, *PsycINFO*, *Scopus*, *Web of Science*, *Cochrane Central Register of Controlled Trials*, and *Published International Literature on Traumatic Stress* were searched with search queries of the general form "(PTSD* OR posttraumatic stress* OR post-traumatic stress* OR traumatic stress*) AND (intervention* OR therap* OR psychotherap* OR treatment*) AND (mechanism* OR mediat* OR via or path*)". We further examined lists of references from the identified studies, recent reviews, and other major contributions in the field to locate any additional studies.

We preregistered the review in the *PROSPERO* database (#CRD42017064837) before work on it commenced. We followed the *Preferred Reporting Items for Systematic reviews and Meta-Analyses* recommendation (Moher, Liberati, Tetzlaff, Altman, & The PRISMA Group, 2009) as closely as possible.

7.1.2 Participants and procedure in Study II

Study II is based on data collected during a cluster-randomized, controlled trial of the TRT in Palestine, in 2009. First, two schools were selected randomly from each of two heavily war-affected areas, Gaza City and North Gaza, from a list of government schools. Then, two classes of boys and two classes of girls were randomly selected from each of the four schools, arriving at 16 fifth- and sixth-grade classes. Finally, by cast lots at each school, one class of girls and one class of boys was assigned to the intervention, and the others to a waiting-list control group.

All children took part in a baseline assessment in April 2009, around three months after the end of the 2008–2009 Gaza War (pretreatment), after the end of the intervention around two months later (posttreatment), and six months after this, around eleven months after the end of the war (follow-up). The children's parents or guardians also answered questionnaires at follow-up. Children in the intervention group were also assessed midway through the intervention (midtreatment). Participating children, their families, teachers, and research assistants were blind to the intervention status of each group of children at baseline. Assessments were carried out by research assistants who were Master's-level students in psychology under the supervision of the senior lead researcher in Gaza, a professor of psychology.

Initially, 500 children were eligible to participate. Ten children or their parents declined to participate, and a further eight were excluded for other reasons. The final participants were 482 Palestinian schoolchildren. They included 240 boys and 242 girls, 10–13 years of age ($M = 11.3$, $SD = 0.7$). Of their fathers, 26% had polytechnic or secondary level and 24% university level education, while 40% of mothers had polytechnic or secondary level and 8% university level education. The rest had preparatory or elementary school education. Unemployment was high, at 48% for fathers and 93% for mothers, as nearly all mothers stayed or worked at home. 86% of children lived in urban areas, 11% in refugee camps and 3% in villages. 89% of the children had citizenship, while 11% were considered refugees. Families were large with an average of 6.2 children. The children reported having been exposed to an average of five types of traumatic war experiences, with 72% having witnessed a violent death, 24% the injury or beating of a family member, and 36% been injured themselves.

There were no significant differences in demographic details between the intervention and control groups, nor in PTCs or depressive symptoms at baseline. However, the control group reported significantly less PTSS at baseline than the

intervention group (M = 27.8, SD = 10.6, vs. M = 32.8, SD = 9.6), despite reporting a higher number of traumatic war experiences (M = 5.3, SD = 2.6, vs. M = 4.6, SD = 2.9).

There were no dropouts between pretreatment and posttreatment assessments, but 78 children (16%) dropped out between posttreatment and follow-up due to their absence from or change in schools. Significantly more boys (23%) than girls (9%) dropped out, possibly due to boys being more likely to seek out work opportunities in the aftermath of the war. Dropouts did not significantly differ from the children remaining in the study with regards to group status, age, mental health at pretreatment and posttreatment (PTSS, depressive symptoms and psychological distress), refugee vs. citizen status, school region, nor parental education, income, or work status.

We used data from all participants in the primary analyses of Study II regarding the effects of TRT on negative PTCs. We used data from the intervention group only in analyses of the trajectories of PTCs during TRT treatment. These 242 children in the intervention group were 10–13 years of age (M = 11.2, SD = 0.8), with 122 boys and 120 girls.

7.1.3 Participants and procedure in Studies III and IV

Studies III and IV are based on data from a randomized, controlled, pragmatic trial our research group carried out, comparing NET to TAU among children and adolescents multiply traumatized by experiences of war and refugeedom or violence in the family. The trial had an open-label, multicentre, parallel-group design, with both intervention and control treatments taking place simultaneously in usual care environments at different specialized and primary care level clinics and units across Finland.

We preregistered the trial in the *ClinicalTrials.gov* database (NCT02425280) before data collection commenced. We also published a detailed study protocol of the trial beforehand (Kangaslampi, Garoff, & Peltonen, 2015). Some changes to the study procedure were necessary after the publication of the protocol. In particular, 1) the inclusion criteria of the study were extended to also allow participation of children and adolescents who had been exposed to repeated interpersonal trauma within the family in the form of physical and/or sexual abuse; 2) we were unable to include the planned assessments of cognitive abilities in the study; 3) as treatment queues were shorter than expected, we were not able to collect a representative waiting-list type

control condition during time spent waiting for treatment; and 4) the limited final sample size did not allow for some of the planned, more sophisticated analyses involving moderators.

The research group trained, in collaboration with developers of the method, 51 experienced mental health professionals, including medical doctors, psychologists, psychotherapists, psychiatric nurses, and social workers, in NET. The trained therapists worked at different treatment units responsible for treatment of posttraumatic symptoms of children and adolescents at different levels, from primary care to specialized inpatient units. Three three-day trainings took place over three consecutive years (2014–2016). The trained therapists received the training gratis in exchange for agreeing to aim to recruit two participants for the study each. The therapists also collected data and carried out assessments with the patients they were treating. In line with principles of pragmatic trials (Thorpe et al., 2009), the researchers got involved in the treatment practices as little as possible.

Recruitment of participants for the study took place between January 2015 and June 2017, and data collection ended in February 2018. The inclusion criteria were 1) between 9–17 years of age, 2) referred to treating unit because of trauma-related mental health problems, 3) active PTSS, confirmed by the therapist based on his/her evaluation and the self-report measure used. A diagnosis of PTSD was not required. Exclusion criteria were 1) psychotic disorders, 2) current severe substance abuse, 3) severe suicidal ideation, and 4) intellectual disability. Randomization was by sealed, opaque envelopes. The research group provided participating clinics with folders, each containing all the relevant material and questionnaires for one participant as well as an envelope with a piece of paper reading either *NET* or *TAU* inside. We provided two folders, one for NET and one for TAU, per therapist. Whenever a clinician identified a child or adolescent coming to them for treatment as a potential participant, they provided information about the research and the interventions involved to the participant and their parents or guardians. If they were willing to participate in research and provided informed consent, they took a folder in random and opened the envelope to determine whether the participant would receive NET or TAU. Not all trained therapists were able to recruit participants for the study over the one to three year recruitment period.

All children and adolescents that agreed to participate were assessed at the start of their treatment (pretreatment) and at the end of their treatment three months later (posttreatment). We also planned assessments for halfway through the treatment and at three-month follow-up. However, there were marked challenges in data collection at these time points. As a result, a notable share of data was missing for the

midtreatment assessment (a total of 57% of data missing for the measures used in Study IV), and follow-up data could only be collected from 22 participants. We made no attempt to blind participants to the type of treatment they received, and as clinicians acted as data collectors, they could not be blinded either.

Figure 5 presents the flow of participants in the study. Initially, clinicians identified 54 children and adolescents eligible to participate, of whom four declined. The sample at baseline thus consisted of 50 children and adolescents between 9–17 years of age (M = 13.2, SD = 3.2), with 29 boys and 21 girls. Of this sample, 37 (74%) were refugees or asylum seekers with experiences of war or refugeedom and 13 (26%) were children of Finnish background with experiences of family violence. Apart from Finland, the most common countries of origin were Iraq (n = 14) and Afghanistan (n = 14). Participants had experienced multiple forms of serious trauma. Of the refugees and asylum seekers, 81% had experienced violence by a stranger and 57% physical abuse by caretakers, 35% had been imprisoned or held captive, and 73% had had family members exposed to violence or torture. All children of Finnish background had experienced physical abuse by caretakers, 46% sexual abuse, and 54% neglect of basic needs.

Despite randomization, the NET and TAU groups were somewhat unequal in size, with 29 in the NET group and 21 in the TAU group initially. This could have been simply due to chance, as with 50 participants there is an about 10% chance of 29 or more of them being randomized into one group. However, it is also possible that some external factor affected the process. For example, it is plausible that clinicians whose first patient was randomized to NET were less likely to actively try to recruit another patient, which would have resulted in less patients in the TAU group. We did not detect any particular irregularities in the randomization process, but they cannot be completely ruled out as explanations either, as clinicians carried out the randomization at their own units. In any case, there were no significant differences between the NET and TAU groups in gender distribution, age, country of origin, or mental health (PTSS, depressive symptoms, psychological distress, resilience) at baseline.

There were seven dropouts during the study, and three more participants completed treatment but did not contribute data at posttreatment. In Study III, we included all participants with data available at posttreatment in primary effectiveness analyses for each outcome and all available data from all participants who were initially randomized to either group in intention-to-treat analyses. For Study IV, examining mechanisms of change, we included only those participants who had completed treatment and for whom some posttreatment measures in PTSS, PTCs

and/or quality of traumatic memories were available. Thus, the final sample for Study IV consisted of 40 children and adolescents, 19 girls and 21 boys, 9-17 years of age (M = 13.3, SD = 3.1), of whom 10 were born in Finland and had experiences of violence in the family and 30 were born outside Finland, mostly in Iraq (n = 11) and Afghanistan (n =11). Of this sample, 23 received NET, while 17 completed TAU.

7.1.4 Intervention in Study II

Study II examined the effects of a slightly modified version of the Teaching Reacover Techniques intervention (TRT; Smith et al., 2000) on negative PTCs. This intervention was selected for both theoretical and practical reasons (Qouta et al., 2012). Many elements of the intervention are evidence-based CBT tools, and they include creative and symbolic methods considered culturally appropriate. A group intervention like TRT was also considered feasible for implementation by local mental health professionals, despite the on-going siege and boycott and general aftermath of the 2008–2009 Gaza War.

The Arabic language version of the manual was used. The standard TRT intervention was modified to better fit local conditions by increasing emphasis on symbolic work thought to be culturally relevant such as dream work, by including an additional session for meeting the children's parents and by changing the timing of some activities. An extended program of eight two-hour meetings, twice a week for four weeks was implemented. Four psychologists acted as intervention providers and ran four groups of 15 children each in parallel, for a total of 16 intervention groups. The intervention sessions took place as extracurricular activity within school premises. Normal schoolwork also continued in both the intervention and control groups.

A senior member of the research group provided training in TRT to the psychologists carrying out the intervention who already had basic training in CBT. He also held weekly preparatory and supervisory meetings with the counselors carrying out the intervention to ensure program fidelity. After the follow-up assessments, the control group received the same intervention.

7.1.5 Intervention in Studies III and IV

Studies III and IV compared narrative exposure therapy (NET; Schauer et al., 2011) to TAU. NET was implemented following the second edition manual (Schauer et al., 2011) with the help of a condensed Finnish translation (Peltonen, 2015). Creative elements from the KIDNET adaptation were used in treatment especially with younger children (Schauer et al., 2017). Treatment consisted of 7–10 weekly sessions of around 90 minutes each, for a total length of treatment of around three months. The number of sessions could be customized for each patient, but was advised not to exceed ten.

We monitored treatment adherence and competence in providing NET through group supervisory meetings for the clinicians with the lead researcher. The trained therapists further participated in tailored group meetings within their own units as NET interventions took place, and received usual statutory external supervision when conducting TAU. No major deviations from NET as described in the manual were noted during supervision. However, we did not systematically assess strict adherence to the NET protocol through methods such as recording treatment sessions or detailed logbooks. This was due to our focus on NET as it would be implemented as part of everyday clinical practice in usual care environments.

For TAU, participants received whatever treatment and attention they would typically receive at the treating unit, with the therapists instructed to implement any intervention(s) they would normally use if no research project were going on. We gave no specific instructions as to what TAU should entail, apart from not including elements specific to NET. No extra resources were provided to implement TAU. Based on information collected about the contents of TAU at posttreatment, it ranged widely from case management, general monitoring and psychosocial support, and network meetings with the child's family and professionals such as social workers and teachers to supportive discussion centered on current problems and life events such as problems sleeping and practical matters and/or family therapy. One participant's TAU was reported to include exposure to the traumatic event. TAU varied in intensity from weekly to monthly sessions and session length varied between 45–90 minutes. Posttreatment assessments were carried out after three months of treatment in the TAU group as well.

As we did not have access to full medical records, we do not have complete details on possible psychiatric medications in use or differences in medication between the two intervention groups. In any case, changes to possible pharmacotherapy were not made during NET, nor were they reported during TAU.

7.2 Measures

In Studies II, III, and IV, we used checklists, scales and questionnaires to assess the traumatic events experienced by participants, their mental health, as well as cognitions and memories related to the trauma. Most measures were based on self-report. In study II, we used Arabic versions of all measures, some of which were translated by the research group. In Studies III and IV, measures were available in Finnish, English, Arabic, Dari, Farsi, and Sorani, and interpreters read translations of the questions and response alternatives to those few children who did not speak any of these languages.

7.2.1 Traumatic events and mental health

Traumatic events. We used a checklist prepared for this study listing potentially traumatic events relating to the 2008–2009 Gaza War to assess exposure to different types of war trauma in Study II. Children endorsed each type of event they had experienced. A total sum score was calculated by summing the number of events endorsed that corresponded to *DSM-IV* criteria (APA, 1994) for a traumatic event.

We used another checklist prepared for the study, based on the Event Checklist for War, Detention, and Torture Experiences (Schauer et al., 2011), the Child and Adolescent Intake Form of the Center for Victims of Torture (not published) and lists of adverse childhood experiences used in previous studies (Dong et al., 2004; Duke, Pettingell, McMorris, & Borowksy, 2010), to assess traumatic experiences in Study III. Nine items related to violent and traumatic experiences during war or refugeedom and nine items related to family violence. The checklist was completed by the treating clinician in consultation with the child and their guardian, and only used for descriptive purposes.

Posttraumatic stress symptoms. We used the 13-item version of the self-report Children's Revised Impact of Event Scale (CRIES; Smith, Perrin, Dyregrov, & Yule., 2003) to assess PTSS in Studies II, III, and IV. The scale includes four items measuring intrusive symptoms (e.g., "Do pictures about it pop into your mind?"), four items measuring avoidance symptoms (e.g., "Do you try not to think about it?"), and five items measuring hyperarousal symptoms (e.g., "Do you have difficulties paying attention or concentrating?"). Children evaluated on 4-point scale (0 = *not at all*, 1 = *rarely*, 3 = *sometimes*, 5 = *often*) how frequently each statement was true for them during the past seven days. Reliability and validity of the scale has been

supported in studies of children and adolescents 8–18 years old exposed to war and conflict (Barron et al., 2013; Perrin, Meiser-Stedman, & Smith, 2005; Smith et al., 2003), as well as natural disasters (Chen, Zhang, Liu, Liu, & Dyregrov, 2012; Lau et al., 2013). However, not all translations used in Studies III and IV have been validated.

We used a total sum score with a theoretical range of 0–65 in Studies II, III, and IV. In Study II, two potential factor structures suggested by previous research were also tested.

Studies have found that an eight-item version of the scale, without items assessing hyperarousal, may perform as well as the 13-item version, and a cutoff of 17 points on the eight-item version appears to indicate a high probability that the child would obtain a diagnosis of PTSD (Perrin et al., 2005; Stallard, Velleman, & Baldwin, 1999). We used this cutoff based on eight items in Study III to indicate probable PTSD.

Depression. We used the 18-item self-report Depression Self-Rating Scale for Children (Birleson, Hudson, Buchanan, & Wolff, 1987) to assess depressive symptoms in Studies II and III. Example items include "I feel like crying." and "I get tummy aches." Children evaluated on a 3-point scale (0 = *mostly*, 1 = *sometimes*, 2 = *never*) how often they felt as described during the last week. Answers are scored so that higher scores indicate more depressive symptoms.

Evidence for the reliability and validity of the scale has been found in studies of, e.g., Swedish (Ivarsson & Gillberg, 1997) and Iranian adolescents (Taghavi, 2006), as well as Nepali (Kohrt et al., 2011) and Burundi (Ventevogel, Komproe, Jordans, Feo, & de Jong, 2014) children. We used a total score with a theoretical range of 0–36.

Psychological distress. We used child- and guardian-rated versions of the Strengths and Difficulties Questionnaire (Goodman, 1997) to assess psychological distress in Study III. The questionnaire includes six subscales with five questions each. Children evaluated on a three-point scale (0 = *not at all*, 1 = *somewhat*, 2 = *yes, fits well*) how well each description fit them. Numerous studies have studied the psychometric properties of the questionnaire and found them generally adequate to good, including the Finnish (Borg, Kaukonen, Salmelin, Joukamaa, & Tamminen, 2012; Koskelainen, Sourander, & Kaljonen, 2000), Arabic (El-Keshky & Emam, 2015; Thabet, Stretch, & Vostanis, 2000) and Farsi translations (Ghanizadeh, Izadpanah, & Abdollahi, 2007). We used a total score summing the emotional problems, behavioral problems, relational problems, and hyperactivity subscales with a theoretical range of 0–50, as recommended by Goodman (1997).

Resilience. We used a 10-item self-report questionnaire developed for this study, partly based on the Child and Youth Resilience Measure (Ungar & Liebenberg, 2011) to assess resilience in Study III. The items relate to positive individual resources, with example items including "I have a skill in which I am particularly good." and "I feel that I am important to someone." Children evaluated on a 3-point scale (0 = *not at all*, 1 = *somewhat*, 2 = *yes, fits well*) how well each description fit them. This measure has not yet been validated, although a validation project is ongoing. We used a total sum score with a theoretical range of 0–20.

7.2.2 Psychological mechanisms of change

Posttraumatic cognitions. We used the 25-item self-report Children's Post-Traumatic Cognitions Inventory (CPTCI; Meiser-Stedman, Smith et al., 2009) to assess maladaptive or overly negative posttraumatic thoughts and appraisals in Studies II and IV. Example items include "Anyone could hurt me." and "I will never be able to have normal feelings again." Children evaluated on a 4-point scale (1 = *don't agree at all*, 2 = *don't agree a bit*, 3 = *agree a bit*, 4 = *agree a lot*) to what extent they agreed or disagreed with each statement.

The measure was originally validated for UK children and adolescents aged 6–18 in community samples and among those exposed to single trauma (Meiser-Stedman, Dalgleish, et al., 2009). A further validation study among UK and Australian children and adolescents confirmed the test-retest reliability and internal consistency of the measure (McKinnon et al., 2016). Good psychometric properties have also been observed for the Korean (Lee et al., 2018) and German translations of the CPTCI (de Haan, Petermann, Meiser-Stedman, & Goldbeck, 2016). However, no validation studies exist for most translations used here in Studies II and IV.

We used a total sum score with a theoretical range of 25–100 in Studies II and IV. In study II, two potential factor structures suggested by previous research were also tested.

Quality of traumatic memories. We used the 11-item self-report Trauma Memory Quality Questionnaire (Meiser-Stedman et al., 2007) to assess problematic qualities of traumatic memories in Study IV. Items of the scale refer to visual and other sensory qualities, temporal context, fragmentation, and extent of verbal accessibility of the memories. Example items include "My memories of the frightening event are mostly picture or images." and "When I remember the frightening event I feel like it is happening right now." Children evaluated on a 4-

point scale (1 = *don't agree at all*, 2 = *don't agree a bit*, 3 = *agree a bit*, 4 = *agree a lot*) how well the provided descriptions fit their traumatic memories. Construct and criterion validity and internal consistency of the measure were established in two samples of trauma-exposed 10–18-year old children and adolescents in the original study (Meiser-Stedman et al., 2007). However, additional validation studies are not, to my knowledge, available. In the sample of Study II, the Arabic translation of the measure demonstrated fair internal consistency (Peltonen, Kangaslampi, Saranpää, Qouta, & Punamäki, 2017). We used a total sum score with a theoretical range of 11–44.

7.2.3 Quality of evidence in reviewed empirical studies

Quality of evidence in reviewed empirical studies. In Study I, we used a 13-item checklist developed for the study before any work on it commenced for assessing the quality of evidence provided by the empirical studies included. We based items of the checklist on the *Cochrane Handbook for Systematic Reviews of Interventions*, the Jadad scale (Jadad et al., 1996), design requirements suggested for mediation studies by Kazdin (2007), as well as on a similar checklist developed by Gu, Strauss, Bond, and Cavanagh (2015).

We used a total sum variable indicating how many conditions of the checklist each study filled. We then classified studies scoring 8/13 on the checklist, which were additionally able to show that changes in mechanisms took place before changes in outcomes, as *high quality / low risk of bias*. We classified other studies scoring at least 6/13 on the checklist as *average quality / moderate risk of bias*, and the remaining studies as *low quality / high risk of bias*.

As the checklist was prepared specifically for this review, it has not been validated or tested. We felt the use of a novel checklist was justified, as no previous checklists or measures adequately covered crucial quality issues related to empirical studies of mechanisms of change.

7.3 Statistical analyses

We used Mplus 7.3 (Muthén & Muthén, 1998–2015) for all analyses in Study II. We used R 3.4.3 (R Core Team, 2017) for all analyses in Studies I and IV and some analyses in Study III. We further used SPSS 24 for some analyses in Study III. In Study IV, we used the *mice 2.9* R package (van Buuren & Groothuis-Oudshroon,

2011) for multiple imputation and the *lavaan 0.6-3* (Rosseel, 2012) and *semTools 0.5-1* R packages (Jorgensen, Pornprasertmanit, Schoemann, & Rosseel, 2018) to allow for maximum-likelihood path analyses in multiply imputed datasets. For linear mixed-effects modeling in Study III, we used the *nlme 3.1-137* R package (Pinheiro, Bates, DebRoy, Sarkar, & R Core Team, 2018). To increase transparency, we retained all R input scripts used and will make them freely available to any interested parties.

7.3.1 Study I

We calculated descriptive statistics on the characteristics and quality of the included studies. We assessed the relationship between year of publication and study quality by a correlation analysis.

7.3.2 Study II

We used linear multiple regression to examine the effects of TRT on PTCs at posttreatment and follow-up, controlling for pretreatment levels. We then used the Wald test to examine gender effects by testing equality constraints for regression coefficients for boys and girls.

For indirect effects, we used maximum-likelihood path analysis based on the correlation matrix to examine mediated effects of the intervention on PTSS at follow-up via effects on PTCs at posttreatment. We used the product of coefficients method with a second-order Taylor series approximation for the standard error to quantify and examine the mediated effect (MacKinnon et al., 2002).

We used latent class growth analysis (Berlin, Parra, & Williams, 2014) to detect trajectories in the level and change of the children's PTCs during the intervention. We estimated linear latent class growth analysis models and selected the best-fitting model based on the Bayesian information criterion and the bootstrap likelihood ratio test (Nylund, Asparouhov, & Muthén, 2007). We then used multinomial logistic regression to study whether gender, age, depressive symptoms, PTSS, or number of traumatic war experiences would predict most likely membership in any particular trajectory (Clark & Muthén, 2009).

We tested two different latent measurement models for PTSS and two for PTCs. However, as clear measurement invariance could not be established between the intervention and control groups, we finally used observed total scores on the CRIES and CPTCI measures instead.

We used a form of Kish correction[1] (Ukoumunne, Gulliford, Chinn, Sterne, & Burney, 1999) to correct unrealistically small estimates of population standard errors that might have resulted from the cluster sampling method and associated non-independence of observations. We used full-information maximum likelihood procedures to account for missing data.

7.3.3 Study III

In primary analyses, we used repeated-measures analyses of variance to examine changes in total PTSS, intrusion symptoms, avoidance symptoms, and arousal symptoms from pretreatment to posttreatment in treatment completers. We set time as a two-level within-subject variable and treatment as a two-level between-subjects variable and examined main and interaction effects. We used similar analyses for depressive symptoms, resilience, and self-evaluated and guardian-evaluated psychological distress. Post hoc power analyses indicate that these analyses were only powered to detect large effects of around $f = 0.5$ at 80% power. We then used *t* tests to examine the significance of within-group changes in total PTSS, intrusion symptoms, avoidance symptoms, and arousal symptoms, for the NET and TAU groups separately.

For assessing clinical significance of changes in PTSS, we used the cut-off score of 17 for the avoidance and intrusions subscales of the CRIES to examine how many participants in each group exceeded this cutoff and thus had probable PTSD at pretreatment and posttreatment. We then used related-samples McNemar tests to check whether within-group changes in the share of probable PTSD were significant.

In intention-to-treat analyses, we used linear mixed-effects modeling employing all available data from all participants at all points of measurement. We modelled the effect of time as weeks elapsed since the pretreatment assessment until each point of assessment. We employed a stepwise model building approach, where we allowed for random intercepts, random slopes, and autocorrelation one by one and retained them if they improved model fit at each step. At the last step, we checked whether adding Time × Treatment interactions would improve model fit and be statistically significant. We assessed improvements in model fit by the Akaike information

[1] In this correction, standard errors of regression parameters in all regression-based analyses were multiplied by the square root of the design effect, $1 + (n - 1) * ICC_x * ICC_y$, where ICC_x is the intraclass correlation coefficient of the covariate and the ICC_y the intraclass correlation coefficient of the dependent variable, and *n* is the average size of the clusters, in this case the average number of children in each class.

criterion and likelihood ratio tests. We computed 95% confidence intervals for all effects. We used visual inspection of residual plots to check for evidence of heteroscedasticity or significant deviations from normality, but found none.

Individual missing item-level responses in otherwise completed measures (a total of 34 data points) were replaced by the response closest to that participant's mean answer to other items of the measure. For entirely missing measures, we used pairwise deletion for each analysis, except for intention-to-treat analyses where we used all available data.

7.3.4 Study IV

We used repeated-measures analyses of variance to assess changes in negative PTCs and quality of traumatic memories over the course of treatment and possible differences between NET and TAU in such changes. Time was set as a three-level within-subject factor (pretreatment, midtreatment, posttreatment) and treatment as a two-level between-subjects factor, and we examined main and interaction effects.

We assessed the relationship between pretreatment to posttreatment changes in negative PTCs and quality of traumatic memories and PTSS by correlation analyses. Finally, for mediation analysis, we used maximum-likelihood path analysis, with separate path models for negative PTCs and quality of traumatic memories. In each model, PTSS at posttreatment were regressed on PTSS at pretreatment, a dummy variable for type of treatment, and PTC/traumatic memory scores at posttreatment. The PTC/traumatic memory scores at posttreatment were then regressed on their values at pretreatment as well as PTSS at pretreatment and the dummy variable for type of treatment. We used the product of coefficients method to estimate indirect effects of treatment on PTSS at posttreatment via PTCs and traumatic memories at posttreatment, and the conservative asymptotic normal distribution method to construct confidence intervals around the estimate to assess the significance of the indirect effect (MacKinnon et al., 2002).

We used multiple imputation by chained equations to account for the notable amount of missing data. We generated fifty imputed data sets to replace missing data at the item level (Gottschall, West, & Enders, 2012). We considered all available variables used in the study as potential predictors, as well as available demographic variables, data on depressive symptoms, psychological distress, and assessments of PTSS, PTCs, and quality of traumatic memories at follow-up, where available. We included as predictor variables for multiple imputation those variables that correlated

at .30 or more with the variable being imputed. We carried out all analyses with these multiple imputed data sets, accordingly marked with an *MI* subscript. Due to large share of missing data at midtreatment and associated imprecision in imputing them, we only used midtreatment data as additional data points in repeated measures analyses of variance and not in mediation analyses.

7.4 Ethical considerations

The board of directors of the Gaza Community Mental Health program and officials in the government of Gaza approved the research for Study II. The ethical boards of Pirkanmaa Hospital District, Tampere City Welfare Services, Helsinki Diaconess Institute, and the Hospital District of Southwest Finland approved Studies III and IV.

Age-appropriate information leaflets about the study were prepared and given to potential participants and their guardians in Studies III and IV. Information sheets about the study and its purpose were also provided to children's parents in Study II. Participation in all studies was voluntary. Oral consent to participate was received from participants and their parents in Study II. Written consent to participate was received from both the participants themselves and their parents or guardians in Studies III and IV. In the NET trial, we performed interim analyses roughly half way through the recruitment period to ensure that NET was not performing worse than TAU to a clinically significant degree.

The authors had no conflicting interests at the time of the studies. Since the completion of Studies III and IV, the authors of these studies have received modest income from organizing clinical training in NET.

8 RESULTS

8.1 Existing evidence on mechanisms of change in psychological treatment of posttraumatic stress symptoms (Study I)

In a systematic review of the literature, we identified 34 controlled studies, published between 2004–2018, fulfilling the inclusion criteria where the role of a mechanism of change in treatment effects was explicitly examined. Nine of these studies were conducted among children or adolescents. Nine studies examined PE, two studies CPT, two studies TF-CBT, seven studies other CBT-based interventions, five studies were on mindfulness or mantram interventions, three studies on cognitive training programs, six on group psychosocial interventions, and five on other individual- or couple-based interventions.

The quality of the studies varied widely and was overall average. Quality has improved over time. Crucially, only slightly over a third of studies had a design where the temporal order of changes in mechanisms and outcomes could be established.

We found good evidence from eighteen studies, of which six were high quality, for changes in negative PTCs as a mechanism of change in several individual CBT treatments. Both cognitively-oriented treatments such as CPT and TF-CBT as well as purely exposure-based treatments like PE appear to have a major part of their effects via affecting negative PTCs. Several studies suggested that change in negative PTCs is a major mechanism of change among children and adolescents, too.

We identified mixed and unclear findings on coping strategies and biases in attention as mechanisms of change. Two studies provided very tentative evidence for improvements in emotion regulation as a mechanism of change. Two studies suggested that reciprocal effects exist between changes in depressive symptoms and PTSS during treatment. Just a single study among children was identified explicitly examining changes in quality of traumatic memories as a mechanism of change. We found some preliminary evidence from three studies that increases in dispositional mindfulness may act as a mechanism of change responsible for reduction in PTSS in mindfulness and mantram interventions.

Table 1. Levels of posttraumatic stress symptoms and negative posttraumatic cognitions at three time points among school-aged children in Gaza, for intervention group receiving Teaching Recovery Techniques intervention (n = 242) and for waitlist control group (n = 240).

	Pretreatment				Midtreatment		Posttreatment				Follow-up			
Measure	Intervention		Control		Intervention		Intervention		Control		Intervention		Control	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
CPTCI	54.95	12.28	55.15	11.49	53.33	12.25	52.22	11.50	50.75	11.76	51.97	10.84	51.32	12.81
CRIES	32.78	9.59	27.79	10.63	27.90	10.55	25.92	11.05	27.41	11.61	24.28	9.82	25.83	9.24

Note. Means and standard deviations of total sum scores presented. CPTCI = Children's Post-Traumatic Cognitions Inventory. CRIES = Children's Revised Impact of Event Scale. [Copyright 2016, International Society for Traumatic Stress Studies. Reproduced with permission. From Kangaslampi et al. (2016). Psychosocial group intervention among war-affected children: An analysis of changes in posttraumatic cognitions. Journal of Traumatic Stress, 29(6), 546–555.]

8.2 Effects of TRT on negative posttraumatic cognitions (Study II)

Table 1 presents the levels of PTSS and PTCs at pretreatment, midtreatment, posttreatment, and follow-up for the TRT and waitlist control groups. Accounting for levels of PTCs at pretreatment, TRT had no significant effect on PTCs at posttreatment (β = 0.13, 95% CI [−0.09, 0.36]), nor at follow-up (β = 0.05, 95% CI [−0.22, 0.33]). In the path analysis model, there was no evidence of a significant indirect effect of TRT on PTSS at follow-up via PTCs at posttreatment (mediated effect = 0.04, 95% CI [−0.04, 0.11]).

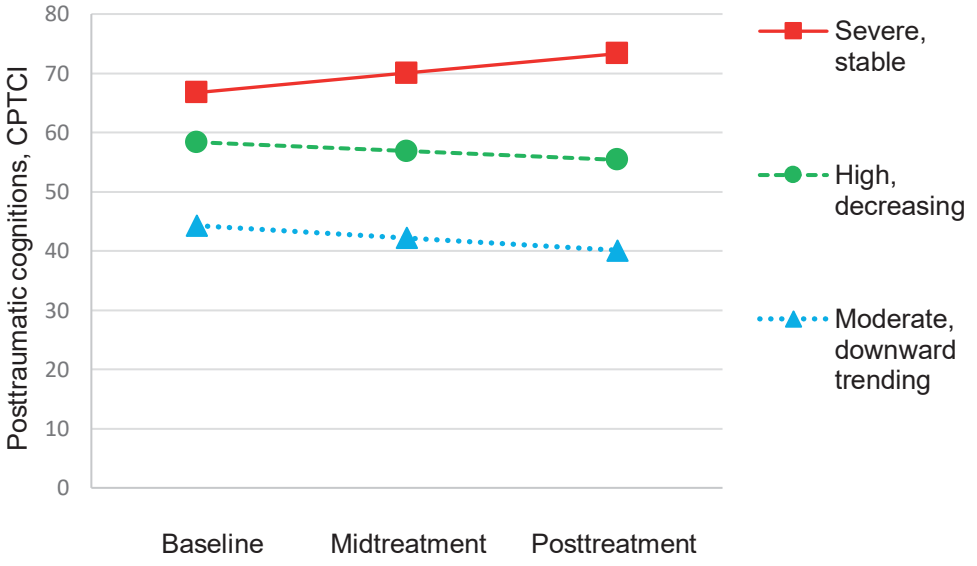

Figure 4. Identified latent trajectories of posttraumatic cognitions among school-children in Gaza receiving the Teaching Recovery Techniques intervention (*n* = 242). Estimated total scores for each trajectory at three time-points. CPTCI = Children's Post-Traumatic Cognitions Inventory. [Copyright 2016, International Society for Traumatic Stress Studies. Reproduced with permission. From Kangaslampi et al. (2016). Psychosocial group intervention among war-affected children: An analysis of changes in posttraumatic cognitions. Journal of Traumatic Stress, 29(6), 546–555.]

8.3 Trajectories of negative posttraumatic cognitions during TRT (Study II)

Figure 4 presents results of latent class growth analysis within the TRT group. We found a three-class model to have the best fit. The model identified three reasonably distinct trajectories: 1) *High, decreasing levels of PTCs* (*n* = 161; 67%), with a high initial level of negative PTCs, but a statistically significant though modest decrease in them over the course of the intervention; 2) *moderate, downward trending levels of PTCs* (*n* = 67; 28%), with initially moderate level of negative PTCs and a trend towards a decrease in them during treatment; and 3) *severe, stable levels of PTCs* (*n* = 14; 6%), with very high initial levels of negative PTCs and a nonsignificant increase in them during treatment.

Higher depressive symptoms and PTSS predicted membership in the *severe, stable levels of PTCs* trajectory compared with the *high, decreasing* trajectory (*OR* = 1.18, 95% CI [1.07, 1.30] for depressive symptoms, and *OR* = 1.16, 95% CI [1.09, 1.23] for PTSS) and with the *moderate, downward trending* trajectory (*OR* = 1.35, 95% CI [1.18, 1.55], and *OR* = 1.18, 95% CI [1.10, 1.26], respectively). More traumatic war experiences and higher depressive symptoms further predicted membership in the *high, decreasing* trajectory compared with the *moderate, downward trending* trajectory (*OR* = 1.24, 95% CI [1.08, 1.41], and *OR* = 1.14, 95% CI [1.04, 1.25], respectively). Gender and age did not significantly predict membership in any trajectory.

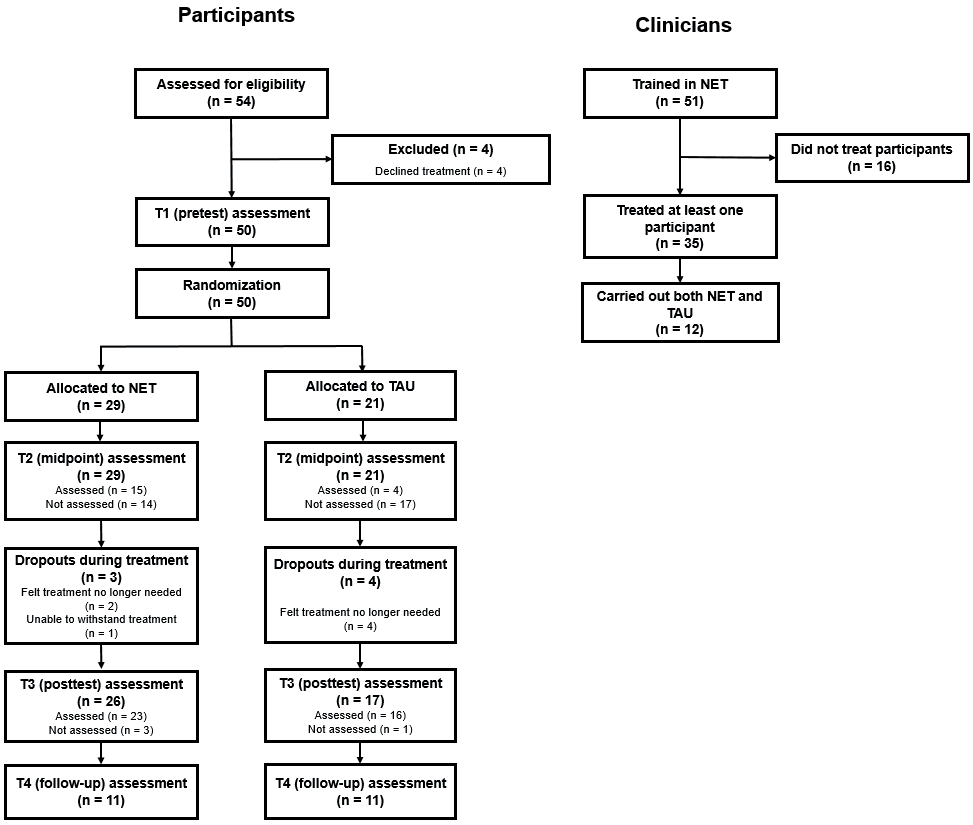

Figure 5. Flow charts of data collection and clinician training and contributions for randomized controlled trial of narrative exposure therapy (NET) versus treatment as usual (TAU) among multiply traumatized children and adolescents.

8.4 Feasibility, safety, and obstacles in carrying out NET in usual care environments of the Finnish healthcare system (Study III)

Figure 5 presents a flow chart of therapist training and contributions to the study. Out of 51 therapists trained in the use of NET, 35 (67%) treated at least one patient and contributed to the study, with 12 treating patients with both NET and TAU. Therapists reported timing of trauma-focused treatment as the major obstacle to treatment, with many worried that a particular child would not be ready to be exposed to their trauma history as would be required in NET. Such concerns seemed

to act as an additional exclusion criterion in practice. Four patients refused participation in the study.

The majority of interventions took place at specialized outpatient clinics by psychologists and psychiatric nurses, with fewer treatments undertaken in primary healthcare and none at inpatient units. Interpreters were used with 73% of the children who were not born in Finland. The quality of interpretation was reported as satisfactory to good.

No serious adverse events such as suicide attempts were reported during treatment. No clients were referred to inpatient clinics during or immediately after the study.

There were seven true dropouts during the study, and three more cases were considered as dropouts due to not contributing any data at posttreatment, despite completing NET treatment. Four participants discontinued treatment in the TAU group and three in the NET group. In six cases, the reason for discontinuing treatment was reported as the child or adolescent no longer requiring treatment according to their own or their guardian's decision. One dropout in the NET group was due to the child or adolescent feeling unable to withstand treatment.

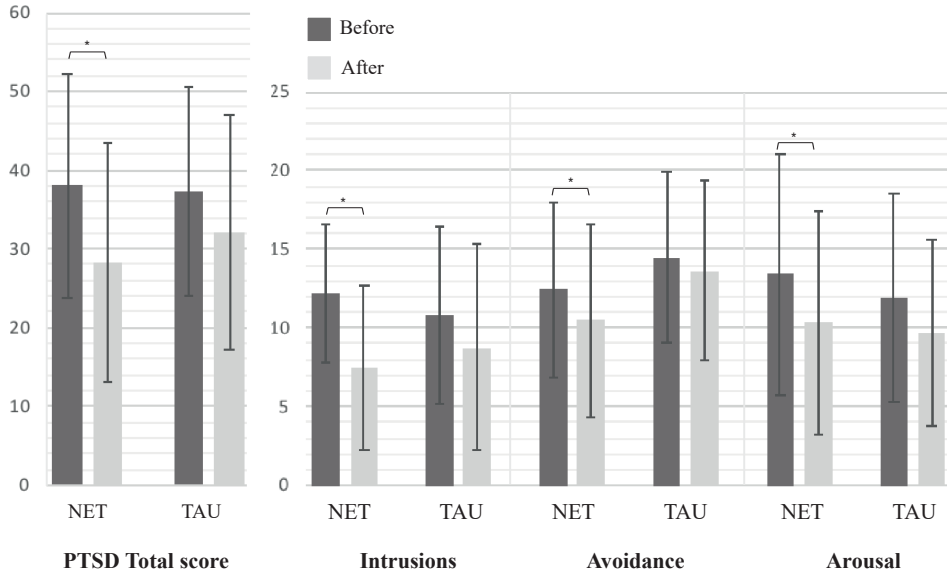

Figure 6. Changes in total posttraumatic stress symptoms and subscales during narrative exposure therapy (NET) and treatment as usual (TAU) among children and adolescents multiply traumatized by war and violence. * $p < .05$ for within-group change according to *t* test.

8.5 Effectiveness of NET versus TAU among multiply traumatized children and adolescents (Study III)

Analyses of variance indicated a significant effect of time from pretreatment to posttreatment for total PTSD symptoms ($F(1,35) = 12.93$, $p < .001$), the intrusions subscale ($F(1,35) = 21.77$, $p < .001$) and the arousal subscale ($F(1,35) = 8.16$, $p = .007$), but not for the avoidance subscale, as well as for psychological distress reported by the child ($F(1,18) = 4.97$, $p = .039$) and the guardian ($F(1,17) = 5.94$, $p = .026$). There was also a significant effect of time on resilience ($F(1,23) = 5.14$, $p = .033$), but no significant effect on depression. The main effects of group (intervention vs. control) and Time × Treatment interaction effects were not significant for any outcomes.

Figure 6 presents the results of within-group analyses for total PTSS and different subscales. For the NET group, decreases from pretreatment to posttreatment were significant and large in effect size for total symptoms, the intrusions subscale and the arousal subscale (PTSD Total score, $t(20) = 3.79$, $p < .01$, Cohen's $d_z = 0.83$; Intrusions, $t(20) = 5.17$; $p < .001$, $d_z = 1.13$; Avoidance, $t(20) = 1.56$, $p = .13$, $d_z = 0.34$; Arousal $t(20) = 2.59$; $p = .017$, $d_z = 0.57$). For the TAU group, decreases were not significant and small to average in effect size (PTSD Total score, $t(15) = 1.46$, $p = .164$, $d_z = 0.37$; Intrusions, $t(15) = 1.93$, $p = .07$, $d_z = 0.48$; Avoidance, $t(15) = 0.052$; $p = .96$, $d_z = 0.01$; Arousal, $t(15) = 1.53$; p = .148, $d_z = 0.38$).

At pretreatment, 23/27 (85%) in the NET group and 16/20 (80%) in the TAU group reported PTSS levels corresponding to probable PTSD diagnosis. At posttreatment, the share of participants exceeding the cut-off was 10/22 (45%) in the NET group and 12/16 (75%) in the TAU group. McNemar tests indicated that the difference in share of participants exceeding the cut-off was significant for the NET group ($p = .008$) but not for the TAU group.

Intention-to-treat analyses with linear mixed models confirmed the general results. PTSS decreased over time ($b = -0.32$, 95% CI [−0.48, −0.15], $SE = 0.081$, $p < .001$) but adding a Time × Treatment interaction did not improve model fit and the interaction was not significant. There was no significant effect of time or Time × Treatment interaction on depression. An increasing trend was observed in resilience ($b = 0.04$, 95% CI [−0.0036, 0.089], $SE = 0.023$, $p = .070$). Significant decreases were observed in self-evaluated ($b = -0.091$, 95% CI [−0.16, −0.09], $SE = 0.033$, $p = .0097$) as well as guardian-evaluated psychological distress ($b = -0.11$, 95% CI [−0.20, −0.11], $SE = 0.045$, $p = .021$). For all these outcomes, adding a Time

× Treatment interaction did not improve model fit and the interaction was not significant.

Table 2. Levels of negative posttraumatic cognitions, problematic qualities of traumatic memories, and posttraumatic stress symptoms at pretreatment and posttreatment for multiply traumatized children and adolescents receiving two types of treatment.

	Narrative Exposure Therapy (n = 23)					Treatment As Usual (n = 17)					Whole sample (n = 40)				
	Pretest		Posttest			Pretest		Posttest			Pretest		Posttest		
Measure	*M*	*SD*	*M*	*SD*	d_{rm}	*M*	*SD*	*M*	*SD*	d_{rm}	*M*	*SD*	*M*	*SD*	d_{rm}
CRIES	37.84	14.41	28.50	14.90	0.64***	35.63	12.31	31.72	14.68	0.29	36.90	13.44	29.80	14.69	0.50***
CPTCI	55.89	13.91	52.01	18.12	0.22	51.40	11.62	50.79	14.61	0.04	53.99	13.02	51.49	16.52	0.16
TMQQ	28.03	7.81	25.99	7.64	0.26*	27.57	7.37	24.03	8.83	0.43	27.83	7.54	25.16	8.12	0.34*

Note. Means and standard deviations of total sum scores presented. CRIES = Children's Revised Impact of Event Sale. CPTCI = Children's Post-Traumatic Cognitions Inventory. TMQQ = Traumatic Memory Quality Questionnaire. Pooled estimates based on 50 multiple imputation sets. * $p < .05$. *** $p < .001$.

8.6 Change in negative posttraumatic cognitions and quality of traumatic memories during treatment of multiply traumatized children and adolescents (Study IV)

Table 2 presents the levels of negative PTCs and quality of traumatic memories at pretreatment and posttreatment for the NET and TAU groups separately and both groups in aggregate. Analyses of variance indicated a significant effect of time on quality of traumatic memories ($F_{MI}(1,1333.56) = 4.77$, $p = .029$), but no significant treatment or Time × Treatment interaction effects. We found no significant effects of time, treatment or Time × Treatment interaction on negative PTCs. In other words, quality of traumatic memories improved over the course of treatment similarly in both NET and TAU, and there was overall no significant change in negative PTCs, regardless of treatment.

8.7 Change in negative posttraumatic cognitions and quality of traumatic memories as mechanisms of change in treatment of multiply traumatized children and adolescents (Study IV)

Changes in PTSS from pretreatment to posttreatment correlated with changes in negative PTCs from pretreatment to posttreatment ($r_{MI} = .46$, 95% CI [.11, .70], $p = .011$) and with changes in quality of traumatic memories from pretreatment to posstreatment ($r_{MI} = .36$, 95% CI [.01, .63], $p = .044$).

In mediation analyses, levels of negative PTCs at posttreatment predicted concurrent levels of PTSS, accounting for pretreatment levels of PTSS ($b_{MI} = 0.54$, $SE = 0.11$, $p < .001$). However, receiving NET vs. TAU did not significantly predict negative PTCs at T3, accounting for pretreatment levels ($b_{MI} = -3.22$, $SE = 3.51$, $p = 0.359$.). We found no evidence of indirect effects of NET on PTSS at posttreatment via negative PTCs at posttreatment (indirect effect = -1.74, 95% CI [-5.61, 2.13]).

Similarly, quality of traumatic memories at posttreatment predicted PTSS at posttreatment, accounting for pretreatment levels of PTSS ($b_{MI} = 0.84$, $SE = 0.24$, $p = .001$). However, receiving NET vs. TAU did not predict quality of traumatic memories at posttreatment, accounting for pretest levels ($b_{MI} = 1.52$, $SE = 2.13$, $p = .477$). We again found no evidence of indirect effects of NET on PTSS at

posttreatment via quality of traumatic memories at posttreatment (indirect effect = 1.27, 95% CI [-2.44, 4.97]).

9 DISCUSSION

This dissertation examined mechanisms of change involved in the effects of psychological treatments for PTSS. Understanding the psychological mechanisms through which treatments are able to affect symptoms could be key to further refinement of existing treatment approaches and the development of new ones, as well as better targeting, training, and dissemination. Previous research on mechanisms of change had a number of gaps and shortcomings. Imprecise definitions of change processes in therapy as well as problems separating events and activities within and outside therapy from each other made it difficult to appraise the level of evidence that currently exists. No comprehensive reviews on the topic were available. There were few studies among children and especially multiply traumatized children, and next to none in usual care environments. No studies had previously examined the mechanisms of change involved in NET, nor the effects of TRT on negative PTCs.

Accordingly, the dissertation aimed to contribute to our understanding of treatment of PTSS in usual care conditions and the mechanisms of change involved in treatment in several ways. First, the dissertation included a comprehensive, systematic review of all available evidence from previous RCTs on mechanisms of change in the treatment of PTSS. Second, we examined the effects of a group psychosocial intervention, TRT, on negative PTCs among war-affected children in Gaza, and the role of changes in PTCs in the intervention's effects. Third, we studied the feasibility and effectiveness of NET in the treatment of multiply traumatized children and adolescents within the Finnish healthcare system as compared with TAU. Finally, we examined negative PTCs and quality of traumatic memories as possible mechanisms of change explaining reduction in symptoms and NET's possible added effectiveness in this context.

9.1 Level of evidence for different mechanisms of change

Over the last ten years, controlled studies have begun to move from examining the simple effectiveness of treatments for PTSS to also examining the mechanisms of

change through which they might achieve their effects. Results of single studies are not enough to argue convincingly for the role of some particular mechanism in the effects of psychological treatments (Johansson & Høglend, 2007). In Study I, our aim was to aggregate results from all available RCTs on mechanisms of change in psychological treatment of PTSS to provide an overview of what mechanisms have been suggested to account for their effects and what the level of evidence for the significance of each mechanism currently is.

The results of our systematic review reinforce the conclusions of previous, more limited reviews among adults (Cooper et al., 2017; Sripada et al., 2016; Zalta, 2015) that change in negative PTCs is a mechanism of change by which a variety of psychological treatments are able to reduce PTSS. Our review extends the evidence to children and adolescents as well. With a strong link between negative PTCs and PTSS established in children (Meiser-Stedman et al., 2019; Mitchell et al., 2017) and several studies demonstrating effects on PTSS via changes in negative PTCs among children and adolescents, we may be reasonably confident that reduction in PTSS can take place via more adaptive, less negative PTCs for school-aged and older children and adolescents as well.

Notably, we found evidence for change in negative PTCs as a mechanism in both treatments including direct cognitive restructuring and those excluding it. With few head-to-head comparisons of different active treatments, it is so far quite unclear whether cognitive interventions are more effective in changing negative PTCs than other types of interventions. Even without actively challenging negative, catastrophizing, or over-general PTCs, different types of active treatment can apparently result in changes in them for both adults as well as children and adolescents. In exposure treatment, this could take place through the client recollecting or reflecting upon features of the traumatic event that are contradictory to current negative PTCs, or through the client connecting their appraisals and thoughts to their specific circumstances and context better, attenuating their over-general nature (Ehlers & Clark, 2000; Foa & Rothbaum, 1998; Schauer et al., 2011). Either way, it appears that improvements in negative PTCs indeed lead to reduced PTSS, in line with predictions of both EPT (Foa et al., 2006) and the cognitive model (Ehlers & Clark, 2000).

On the other hand, the review highlights the very limited evidence available on changes in quality of traumatic memories as a potential mechanism of change. We found only a single study among children with single-incident trauma providing limited evidence for such a path to reduced PTSS. Together with mixed evidence on links between features of the traumatic memory and PTSS overall, as detailed in

Section 4.3.2, this paucity of research means that predictions of the cognitive model (Ehlers & Clark, 2000) and dual representation theory (Brewin et al., 1996) on the importance of integrating and processing the traumatic memory to recovery from PTSS remain empirically unproven. The notable challenges involved in operationalizing and measuring (subjective) quality of traumatic memories may explain the lack of sustained research in this area in the context of controlled studies of treatments.

We found only mixed results from a few studies on reduction in the use of maladaptive coping strategies as a mechanism of change. Thought suppression, rumination, and experiential avoidance have been linked to higher levels of PTSS (Ehlers et al., 2003; Meiser-Stedman et al., 2014; 2019; Seligowski et al., 2015; Simon et al., 2010; Szabo et al., 2017). Still, the prediction of the cognitive model (Ehlers & Clark, 2000) that change in such coping strategies would allow trauma survivors to modify their PTCs and traumatic memories remains speculative in relation to treatment. Evidence on reducing PTSS through affecting attentional biases is likewise lacking.

We also found research on other, more treatment-specific mechanisms of change to be so far quite limited. However, findings from a few studies among adults did suggest that mindfulness-based interventions may be able to reduce PTSS through improving dispositional mindfulness. There is some risk here of the proposed mechanism of change being so collinear with the treatment provided as to be indistinguishable from it (Kraemer et al., 2002). Increased mindfulness appears to be associated with improved self-regulation in terms of more adaptive coping strategies and enhanced emotion regulation, as well as with improved attention, cognitive and emotional flexibility, and self-compassion (Boyd et al., 2018; Mathis, Dente, & Biel, 2019). It may make more sense to speak of and study these more precise processes as the underlying mechanisms of change in mindfulness-based interventions. Still, together with emerging evidence on the effectiveness and neurobiological correlates of mindfulness interventions (Boyd et al., 2018; Hopwood & Schutte, 2017), these initial findings suggest a possible unique pathway to reducing PTSS through a non-trauma-focused method that may be of clinical relevance.

Mindfulness-based stress reduction programs have been successfully implemented among children and adolescents as well (Perry-Parrish, Copeland-Linder, Webb, & Sibinga, 2016; Mathis et al., 2019). However, it remains to be demonstrated whether clinical-level PTSS among children and adolescents might also be ameliorated through interventions aimed at increased mindfulness.

9.2 Negative posttraumatic cognitions during TRT

Evidence for the effectiveness of TRT (Ali et al., 2019; Barron et al., 2013; 2016; Ehntholt et al., 2005; Qouta et al., 2012; Sarkadi et al., 2018) in reducing PTSS among war-affected children is mixed. In the trial Study II is based on, effects on PTSS were, depending on interpretation, limited (Qouta et al., 2012) or even non-significant (Palosaari, 2016). Research on other similar group-based psychosocial interventions has likewise found mixed results (Brown et al., 2017; Morina et al., 2016). Links between change in negative PTCs and subsequent amelioration of PTSS are well established. As such, examining whether and for which children interventions such as TRT can positively affect PTCs could be key to understanding the apparently divergent effectiveness of group psychosocial interventions in different contexts.

We hypothesized that TRT would lead to reductions in negative PTCs compared with waitlist and that such reductions would act as mechanisms of change partially explaining TRT's effects on PTSS. However, we found no evidence of TRT significantly reducing negative PTCs among war-affected children in Gaza. Changes in negative PTCs did not act as a mechanism of change in reducing PTSS in the long term, either. We were able to separate differing meaningful trajectories in PTCs during treatment. The identification of a small trajectory of severe, stable negative PTCs, where negative PTCs might have actually increased over the course of treatment is concerning. High depressive symptoms, PTSS, and more war experiences predicted likely membership in this trajectory.

These findings suggest that for children with particularly severe traumatic exposure and resulting mental health problems, negative PTCs are less likely to reduce during a group psychosocial intervention such as TRT and may even intensify. Some other trials on group psychosocial interventions have specifically excluded children with very high or clinical-level mental health symptoms. This was not the case in our trial, which may explain some of these results. Among others, Tol et al. (2010) have called for stronger separation of universal and indicated interventions and suggested that more preventive interventions aimed at promoting resilience may even slow down recovery of children with substantial PTSS.

With change in negative PTCs established as a viable mechanism through which PTSS may be reduced, the inability of TRT to significantly affect the trauma-related negative appraisals and thoughts of these war-affected children may help explain the intervention's limited overall effects on PTSS. Qouta et al. (2012) further found the effects of TRT in this trial to be gender-specific. However, we did not find gender

to be associated with likely PTC trajectory membership. The effects (or lack thereof) of TRT on PTCs appeared independent of gender as well. Thus, differential effects, level or change in PTCs are unlikely to account for the findings on gender-specific reductions in PTSS.

Plausible explanations as to the lack of observed effects on PTCs include the general ineffective or unsuitable nature of the intervention itself or the prevailing conditions under which it was implemented. Evidence of group psychosocial interventions similar to TRT affecting negative PTCs have not, to my knowledge, been presented. No direct point of comparison in previous studies exist for the identified trajectories either. Regarding the more general construct of hope, Tol et al. (2010; 2014) presented mixed findings on a classroom-based psychosocial intervention improving hope among war-affected children. They did not find evidence for hope mediating improvements in PTSS. There is so far no evidence that group psychosocial interventions such as TRT are able to correct overly negative or general PTCs among war-affected children.

Considering the context of the study, although the 2008–2009 Gaza War had been over for some months when the study started, the children continued to live in conditions of material hardship and widespread destruction, unresolved political conflict, and uncertainty. With the events of the war fresh in the children's minds, efforts to change their perspectives and appraisals may have been untimely. Some of the PTCs thought to be maladaptive in most conditions, such as the world being inherently dangerous and unpredictable, may have also been quite realistic in the current lives of the children and therefore difficult to alter. In the context of Gaza, where we cannot really speak of the trauma being in the past, everyday experiences of the children were more likely to confirm, rather than challenge, their negative PTCs.

9.3 Feasibility and safety of NET in a usual care context

There is some on-going debate about whether trauma-focused treatment can be safely implemented and should be used among survivors of repeated, complex trauma (Cloitre et al., 2012; De Jongh et al., 2016). Clinicians also often report concerns and negative beliefs about exposure treatment, including the possibility of iatrogenic harm, such as exacerbation of PTSS or self-harming behavior, unsuitability for patients with comorbid problems, or increased dropout due to the treatment's intolerability (Becker, Zayfert, & Anderson, 2004; Deacon et al., 2013).

Though such beliefs are generally unfounded (Olatunji, Deacon, & Abramowitz, 2009), they appear to explain problems in dissemination such that clinicians trained in exposure-based treatment may not use it much in clinical practice or may be over-cautious in implementing it (Becker et al., 2004; van Minnen, Hendriks, & Olff, 2010; Schumacher, Weiss, & Knaevelsrud, 2018).

Our findings in Study III suggest that NET, a form of trauma-focused, exposure-based treatment, can be safely and successfully implemented for children and adolescents exposed to multiple traumatic events, which in most cases would fulfill definitions of complex trauma (Cloitre et al., 2012). We found such treatment to lead to treatment outcomes that are at least on par and possibly slightly superior to TAU as currently carried out in the Finnish healthcare system. Further, we did not find significantly higher dropout rates or serious adverse events to occur during NET compared with the mostly non-trauma-focused TAU. These findings, though based on a fairly limited sample, are in line with much previous research on the safety (Olatunji et al., 2009) and feasibility (Jensen et al., 2014; Ruf et al., 2010) of exposure treatment. Treatments such as NET appear suitable for clinical practice in usual care environments of high-income countries with multiply traumatized children and adolescents, as well.

We did, however, note some challenges in dissemination and implementation of the treatment. A third of trained clinicians failed to start any treatments in relation to the study. Some reported that this was simply because no suitable participants entered treatment at their unit. In other cases, clinicians expressed concerns about appropriate timing of trauma-focused treatment and whether their patients would be able to withstand such intensive treatment in their current condition. These concerns may reflect the sort of negative beliefs about risks involved in exposure therapy identified in previous studies (Deacon et al., 2013). The three-day training program we organized appeared thorough enough for clinicians to implement NET successfully. However, more comprehensive and longer training with added emphasis on the safety and applicability of exposure could improve clinician confidence and readiness to employ exposure treatment in their every-day clinical work. Farrell, Kemp, Blakey, Meyer, and Deacon (2016) found results to this effect in comparing a standard versus enhanced training program in exposure therapy.

In terms of the locations where NET treatment appeared most practicable, we observed the highest ratio of treatments to trained clinicians in specialized, outpatient care. Treatments in primary healthcare were rarer, and no trained clinicians at in-patient units carried out treatments in relation to the study. Schumacher et al. (2018) noted many clinicians perceive the long and variable length

and number of sessions as an additional practical barrier to employing exposure treatments in clinical practice. Such practical issues might explain the lower number of treatments initiated in primary healthcare. At inpatient units, there is typically no limitation as to how long a single meeting with a patient can take, but lengths of total stays at such units may be perceived as too short for interventions such as NET.

We found no evidence that the use of an interpreter would lead to worse treatment outcomes. This is in line with some previous results among adult refugees (d'Ardenne, Ruaro, Cestari, Fakhoury, & Priebe, 2007; Lambert & Alhassoon, 2015) but contrary to what Sander, Laugesen, Skammeritz, Mortensen, and Carlsson (2018) found in a large retrospective study of psychotherapy with adult refugees, where mediation by interpreters was associated with slightly worse treatment outcomes. The use of an interpreter in psychological treatment is usually dictated by necessity, not choice, but at the very least, our results together with previous findings suggest that interpreter-mediated therapy is feasible and worthwhile, and can be efficacious also among children and adolescents traumatized by experiences of war.

9.4 Effectiveness of NET for children and adolescents multiply traumatized by war and violence

Although NET is a relative newcomer among trauma-focused treatments for PTSS, evidence has already accumulated about its effectiveness (Catani et al, 2009; Lely et al., 2019; Ruf et al., 2010). However, most studies have involved war-affected people in or near their country of origin, in post-conflict conditions, and used local, lay counselors. Just one study exists among children and adolescents resettled into Europe (Ruf et al., 2010). Additionally, only one study has previously compared NET with TAU (Stenmark et al., 2013), and no similar studies exist among children and adolescents.

We hypothesized that NET would be more effective than TAU as provided within the Finnish healthcare system in reducing PTSS, depression, and psychological distress, and improving resilience for children and adolescents multiply traumatized by experiences of war or violence. However, we did not find evidence that the effects of NET on mental health symptoms or resilience at posttreatment would be different from those of TAU. PTSS and psychological distress decreased and resilience improved equally in both groups, while we found no significant changes in depression over the course of treatment. Still, we did find NET to reduce the share of children and adolescents with probable PTSD more than TAU. Further,

we observed particularly large reductions in intrusive symptoms with NET, suggesting that this may be where NET is at its most effective. The limited sample size and associated low power to detect smaller than large-sized effects preclude strong conclusions about superiority of NET compared with TAU.

Compared with previous trials of NET among children and adolescents (Catani et al., 2009; Ruf et al, 2010) as well as a fairly similar trial of TF-CBT versus TAU (Jensen et al., 2014), our results are less impressive. Ruf et al. (2010) found NET to lead to very large pre-post reductions of $g = 1.9$ in total PTSS among refugee children and adolescents in Germany, compared with $g = 0.7$ in our study. Besides issues of measurement, explanations for this better success likely include the fact that treatments took place at a specialized clinic by clinicians highly trained and experienced in NET and in treating multiply traumatized patients in the Ruf et al. (2010) study. Meanwhile, our pragmatic trial took place in usual care conditions with clinicians newly trained in NET and treating their first patients with the method. Their more encouraging results may also be explained by the later point of measurement Ruf et al. (2010) had for effects on PTSS, four weeks posttreatment versus immediately at posttreatment in our study. PTSS have tended to continue to decrease after NET in previous trials (Ertl et al., 2011; Schaal et al., 2009).

Our results are similar to those of Catani et al. (2009) among Sri Lankan children in that effects of NET on levels of symptoms were not different from an active control condition. However, Catani et al. (2009) also found far larger reductions in overall PTSS and in intrusions, avoidance, and hyperarousal separately, both with NET and a meditation-relaxation program, than our study did. Natural recovery may have accounted for much of these reductions in the Catani et al. (2009) study, as it was carried out only a few weeks after the tsunami. The traumatic events our participants had experienced were typically years in the past, and further natural recovery was quite unlikely.

Also studying multiply traumatized youth in close to usual care conditions at community clinics in Norway, Jensen et al. (2014) found TF-CBT superior to TAU with a pre-post effect of $d = 1.3$ and a controlled effect of $d = 0.5$ in self-reported PTSS at posttreatment. However, although the youth in this study had experienced an average of 3–4 traumatic events, they were not as severely traumatized as our participants, and there was little exposure to war. The vast majority were also ethnic Norwegians, so issues of cultural difference or interpretation did not affect results. Finally, clinicians providing TF-CBT were different to those providing TAU and more experienced. These facts may explain their better results. In our study, it is possible that those trained clinicians who did eventually treat patients and contribute

to the study were generally more competent and experienced in treating young multiply traumatized patients. If this was the case, the TAU they provided was likely also of high quality and effectiveness. Further, some of the skills they had learned in NET training may have spilled over to the TAU they also provided.

Previous studies on NET with children did not measure changes in psychological distress or resilience, so no immediate points of comparison exist. Jensen et al. (2014) did find large reductions in self-reported psychological distress at posttreatment with TF-CBT, whereas improvements in our study were small in effect size. Regarding depression, the meta-analysis by Lely et al. (2019) reported a small to medium sized reduction of $g = 0.47$ in depressive symptoms at posttreatment for NET vs. non-active control conditions, but no effect when NET was compared with active controls. Here, too, the early point of measurement may have affected our results, which indicated no significant change in depressive symptoms. Ertl et al. (2011) in their study of former child soldiers in Uganda, including young adults up to 25 years old, actually found depressive symptoms to be worse at three months posttreatment compared with baseline in both those receiving NET and those participating in an academic catch-up program. By 12-month follow-up, this had turned to small reductions in depressive symptoms compared with baseline. In light of such findings, it is not surprising that we did not observe significant improvements in depression here, either. However, results obtained by Jensen et al. (2014) for TF-CBT were again superior, and indicated large-sized reductions in depressive symptoms at posttreatment.

Though comparisons to TAU are highly valuable from a clinical perspective, TAU as control condition makes it challenging to compare the results of different trials, as TAU may entail a variety of levels and intensities of treatment (Löfholm, Brännström, Olsson, & Hansson, 2013). Direct comparisons of especially NET and TF-CBT are called for to determine whether there is any difference in effectiveness between these two evidence-based treatments among children and adolescents, or whether these differing findings relate to the somewhat dissimilar samples, contexts, and approaches of the existing studies. Conceivably, some particular children, e.g., those with severe war-related trauma, may benefit more from NET, whereas TF-CBT with its comprehensive, partly phased approach might suit those with significant (comorbid) depression better.

9.5 Negative posttraumatic cognitions and quality of traumatic memories in treatment of children and adolescents multiply traumatized by war and violence

Despite some evidence of NET's effectiveness in treating PTSS among children and adolescents (Catani et al, 2009; Ertl et al., 2011; Ruf et al., 2010; Schaal et al., 2009), its possible mechanisms of change had never been explicitly studied. As theories of PTSD suggested change in negative PTCs and improvement in the quality and integration of traumatic memories as key mechanisms of change, we studied their role in the treatment of multiply traumatized children and adolescents with NET and TAU. We hypothesized that, while participants in both NET and TAU were likely to experience change in both mechanisms, NET would result in more marked improvements and that such changes would act as mechanisms of change accounting for some of NET's added effectiveness in reducing PTSS.

The results of Study IV provided some support to the idea that change in negative PTCs and quality of traumatic memories are linked to recovery from PTSS, as changes in both proposed mechanisms were associated with reduction in PTSS from pretreatment to posttreatment. However, our hypothesis on NET's larger effects on these mechanisms was not supported, as there was no differential effect of NET versus TAU on either mechanism. Thus, they also did not act as mechanisms of change in NET's effects on PTSS as compared with TAU, as indicated by no significant mediated effects. Further, average changes in negative PTCs and traumatic memories over the course of treatment were small and for negative PTCs, not statistically significant.

NET includes little explicit cognitive restructuring or other elements directly challenging negative PTCs. However, other studies have found larger changes in negative PTCs with exposure-based treatment (Cooper et al., 2017). Indeed for PE, the addition of a cognitive restructuring component did not appear to increase the overall effectiveness (Foa et al., 2005), nor its effects on PTCs (Foa & Rauch, 2004). Conceivably, treatment approaches more able to affect PTCs in multiply traumatized children and adolescents could still be developed. However, the lack of effects on PTCs in this study may also be more due to the characteristics, context, and population of the study than NET as a treatment method.

The negative PTCs in our participants had likely developed over a longer periods of time as a result of repeated exposure to quite severe traumatic experiences related to war or violence. This could explain why their cognitions appeared more resistant to change than those of children with single-incident trauma who have mostly been

previously studied, as Study II showed. However, among multiply traumatized adolescents in Norway, Jensen, Holt, Ormhaug, Fjermestad, and Wentzel-Larsen (2018) did find TF-CBT to lead to clearly larger reductions in negative PTCs than NET did in our study. Here, as in the primary analyses in Jensen et al. (2014), their less severely traumatized sample of mostly adolescent girls and more experienced therapists may explain better results. Clinicians with less experience in exposure methods and possible concerns about its suitability may be overly cautious in its implementation, which could limit success in changing negative PTCs (Deacon et al., 2013). Some of the participants in our study were also asylum-seeking adolescents, who likely experienced continued stress and anxiety due to uncertainty about receiving asylum, which might also contribute to keeping up a sense of threat and unpredictability. I am not aware of other studies of negative PTCs in treatment of asylum-seekers or recent refugees.

As Study I pointed out, the role of improvements in qualities of traumatic memories in treatment of PTSS is far from established. Despite its methodological shortcomings, our finding that improvement in the self-reported quality of traumatic memories was linked to recovery from PTSS, regardless of type of treatment, adds to the very small amount of evidence we have on the relevance of such improvements to treatment. Unfortunately, we were unable to establish whether changes in memories led to changes in PTSS or vice versa. Our results are also compatible with the possibility that experiencing one's traumatic memories as more organized, less fragmented and better integrated may be a side effect or consequence of successful emotional processing and treatment of the trauma, rather than a mechanism of change through which improvement in symptoms occurs (Foa et al., 2006). Even if that is the case, this does not necessarily mean that we should not target traumatic memories and their qualities in treatment. But it would mean that changes in them should more properly be thought of as indications of successful treatment and not mechanisms of change. More studies where the temporal order of changes is carefully examined are needed to better understand the dynamic of these changes. It also remains to be established whether change in quality of traumatic memories is a specific mechanism of change of exposure-based treatments such as NET or can in fact occur in any active treatment.

9.6 Methodological issues in studying mechanisms of change as mediators

Some particular methodological issues are apparent in contemporary research on mechanisms of change based on our findings in Study I on existing controlled studies of mechanisms of change and our own experiences of studying mechanisms of change in two different interventions in Studies II and IV. These issues relate to two similar, but differing approaches taken to model change over time, to problematic, implicit assumptions in the typical approach taken to mediation analysis, and the causal interpretation and clarity of claims and findings.

To begin with, two different approaches to modeling mechanisms of change as mediators in longitudinal studies were apparent in Study I. The first approach explicitly studies the effect of the intervention versus a control condition on the outcome and the role of the mediator in accounting for this effect. In the second approach, typical for linear mixed models, the effect of time on the outcome and the role of the level of the mediator at a preceding time in accounting for this effect are first quantified. The possible differences between intervention and control conditions is then studied by a possible moderating, i.e., interaction, effect on the (mediated) effect of time. Though in terms of statistical analyses, these two approaches are not far removed from each other, there is a subtle difference in how their findings can be interpreted. Some confusion on the topic is apparent in the empirical literature.

Studying what mediates the effect of the passage of time on symptoms during participation in an intervention is not equal to studying the mediated effects of an intervention, despite several studies claiming otherwise (e.g., Nitzan-Assayag et al., 2017). First, there is the problem of causal interpretation. What, precisely, are we quantifying when we speak of the effect of the passage of time? We are measuring change over time, due to whatever causes. When we evaluate change during one treatment by itself, there are several possible sources of change artifacts, including regression to the mean, expectation effects, natural recovery, and drift in measurement (Kraemer et al., 2002). Changes in mechanisms, i.e., mediators, may just be correlates of such artifact effects. People do recover from PTSS naturally with the passage of time or due to specific factors unrelated to the treatment. Such treatment-independent recovery may also lead to change in the purported mechanisms or be predicted by changes in them.

For these reasons, I would argue there is a difference between changes occurring in symptoms over time (during treatment or otherwise) being predicted by slightly

prior changes in suggested mechanisms, and the effects of a treatment, as contrasted with no treatment or another treatment, leading to changes in the symptoms through effecting change in the suggested mechanisms. Though both approaches can be informative for research on mechanisms of change, for sake of clarity, I would suggest clear separation of these two approaches.

Beyond these different approaches, even when evidence for the role of a mechanism of change in an intervention's effects is based on a mediational analysis in a RCT, the statistical and experimental approach taken in our Studies II and IV and in nearly all studies included in the review in Study I has a number of problems. These problems relate to problematic assumptions that are implicit in the type of analysis used.

First and most basic, Kraemer et al. (2002) have pointed out that the typical approach to mediation analysis taken in psychological research discounts the possibility of an interaction effect between the treatment and the mechanism on the outcome. That is, treatment may affect not just the mechanism, but also the impact the mechanism has on the outcome. A few studies we identified in Study I did account for this possibility by using the alternative MacArthur approach to classic mediation analyses (Kraemer, Kiernan, Essex, & Kupfer, 2008), but most did not. Muthén and Asparouhov (2015) show that if this possibility is not considered, possible interaction effects are subsumed into the direct (non-mediated) effect.

More fundamentally, making causal claims about indirect effects via mechanisms of change in mediation analyses rests fundamentally on the sequential ignorability assumption (Imai, Keele, & Tingley, 2010), that is, the ignorability of confounding variables affecting either the intervention to mechanism or the mechanism to outcome relation. In a RCT, the causal interpretation of the effect of participation in the intervention or otherwise on the mechanism of interest is straightforward and the assumption is reasonable for this part of the causal chain. Ceteris paribus, only the intervention could have caused the difference in the mechanism between the intervention and control conditions. However, this does not extend to the mechanism-outcome relation, which we cannot interpret as a causal effect in a straightforward manner (MacKinnon & Pirlott, 2015). As Bullock et al. (2010) point out, due to omitted or confounding variable bias, typical approaches to mediation yield biased estimates of causal parameters, even in cases where there is randomization in relation to treatment, particularly inflated estimates of the mechanism-outcome relation. Unmeasured confounding variables affecting the mechanism to outcome relation may even represent true underlying mechanisms.

Manipulating or randomizing in relation to the mediator or mechanism directly in an experiment could solve the issue of confounding in the mechanism-outcome relation. However, when studying mechanisms of change in psychological treatments, it is difficult to conceive of such manipulations of any one mechanism that would not affect the nature of the treatment nor other possible mechanisms (MacKinnon & Pirlott, 2015). Indeed, in Study I, we found no evidence of researchers taking up Kazdin's (2009) suggestion of knock-out studies on psychological treatments, where a proposed mechanism of change would be not allowed to function for some of the participants, but would function normally among others. A few of the included studies could, however, be described as dismantling studies, where a treatment including a particular element was compared to that same treatment with that element excluded, corresponding to manipulation of therapy change processes.

Apart from interventions on the mechanism, we could also mitigate problems in causal interpretation of the mechanism to outcome path by other methods. Suggested statistical methods include analyzing the sensitivity of results on indirect effects to confounders of the mechanism to outcome relationship (Imai, Keele, & Tingley, 2010; Imai, Keele, & Yamamoto, 2010; VanderWeele, 2010), use of principal stratification (Gallop et al., 2009; Joffe, Small, & Hsu, 2007) or inverse probability weighting (Coffman, 2011; Coffman & Zhong, 2012). In our review in Study I, we identified very few examples of any of these other techniques employed in studies of mechanisms of change in treatment of PTSS. At least sensitivity analyses could be implemented with relative ease, using practical approaches such as those described by Imai, Keele, and Yamamoto (2010) or VanderWeele (2010). Inverse probability weighting could also well hold promise for psychological research (MacKinnon & Pirlott, 2015).

The one technique to improve causal interpretation of claims that identified studies did apply was referring to earlier studies that had in some way established the causal effect of the mechanism on the outcome. For example, to the extent that uncontrolled studies have already established that improvements in posttraumatic cognitions lead to reduction of PTSS, the causal interpretation of this mechanism-outcome relation is less problematic. In our review, we only included studies that examined the entire chain of effects from treatment to mechanism to outcome. Such examinations in a controlled study are one way of establishing causal chains, but not the only one. Alternatively, the chain could be established through multiple studies focusing on different parts of the chain (Bullock et al., 2010; MacKinnon & Pirlott,

2015). Systematically examining such cumulative evidence lay outside the scope of our review, but is also worthy of careful consideration.

Finally and as a partial solution to some of these problems, I argue that the field of intervention studies in psychology and psychiatry is overdue for a "causal inference revolution" similar to that which has taken place in epidemiology (Hernán & Robins, 2019; Pearl, 2018; though see Krieger & Davey Smith, 2016; 2018 for criticism). Presenting hypotheses and reporting results of mediational analyses using the counterfactual or potential outcomes framework of causal inference could significantly elucidate the exact assumptions and causal claims made (Imai, Keele, & Tingley, 2010; Knight & Winship, 2013; Muthén & Asparouhov, 2015; Pearl, 2001). In counterfactual nomenclature, it is *natural direct* and *natural indirect effects* that we are typically interested in when evaluating mechanisms of change and their contribution to intervention effects (VanderWeele & Vansteelandt, 2009). The indirect effect the usual psychological approach to mediation examines is the *pure natural indirect effect*[2] (Muthén & Asparouhov, 2015). This effect assumes no unmeasured confounding in treatment-outcome, treatment-mediator, and mediator-outcome relations, as well as no mediator-outcome confounders affected by treatment (VanderWeele & Vansteelandt, 2009; Valeri & VanderWeele, 2013). But there are alternative ways indirect effects may be quantified and effects decomposed, with different assumptions, in particular the *total natural indirect effect*, which does not assume linear relations between treatment, mechanism and outcome (VanderWeele & Vansteelandt, 2009). So, in addition to improved clarity on claims and assumptions, using definitions of the causal inference literature, we could extend analyses of mechanisms of change and their contribution to effects of interventions to settings with interaction effects and non-linear models.

9.7 Strengths and limitations

As all research, ours too contains particular strengths, but also a number of clear limitations. To begin with the positives, throughout this dissertation, I have attempted to be clear in definitions of what it is we are studying as mechanisms of change and separate them from other elements of change in psychological treatment. I hope this may also contribute to some clarity in the field more widely.

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[2] Defined as $E(Y(0, M(1)) - Y(0, M(0))$, where $Y(x, m)$ is the outcome at $X = x$ and $M = m$, X is a dummy binary variable representing intervention status, and $M(x)$ is the value the mechanism takes at $X = x$ (Muthén & Asparouhov, 2015).

Regarding the trial that Study II draws data from, a notable strength is that such a trial was possible at all in the difficult circumstances of post-war Gaza. I am greatly in debt to my colleagues both in Finland and in Palestine for designing and implementing such an ambitious study in very difficult conditions. The study also had a relatively large sample, a properly (cluster) randomized design, and several points of measurement – important methodological strengths often lacking in previous research on group psychosocial interventions.

The systematic approach and wide scope of the review in Study I increases my confidence that it managed to capture all available evidence from RCTs on mechanisms of change as we defined them. Including non-trauma-focused treatments and studies among children meant we were able to locate some evidence for mechanisms of change earlier reviews had missed or glossed over. The review was also preregistered.

The real-life, usual care setting of the trial Studies III and IV are based on is a source of several strengths. As detailed below in Section 9.8, the pragmatic approach ensured that the trial was directly clinically useful and addressed topical needs identified in the Finnish healthcare system. The results of the studies are also generalizable to at least similar healthcare systems in high-income countries. Comparing NET to TAU, which in this case mainly represented the highest quality of care currently available for traumatized children and adolescents in specialized outpatient care, provided for a robust, rigorous test of NET's effectiveness. In our trial, we examined the effects of NET as implemented by clinicians of different backgrounds after a relatively brief training with limited supervision, without strict controls such as video recording in place to ensure treatment adherence. This approach is both a strength and a limitation. The results likely provide a realistic picture of the results clinicians in Finland or similar environments carrying out NET treatment in their everyday clinical practice may achieve immediately after receiving training in it. At the same time, we cannot claim that our results reflect effects of NET strictly as defined in the manual. Clinicians may have emphasized different elements and some may have made adjustments or customizations, added some elements or dropped others, depending on their previous training and background. All this makes it somewhat more difficult to compare our results to previous studies in more ideal or controlled circumstances, and likely resulted in somewhat less impressive results compared with TAU.

Other strengths of Studies III and IV include the preregistered nature of our analyses regarding both outcomes and mechanisms of change. Though quite a number of changes were necessary to the study protocol over the course of the study,

we had at least publicly specified the analyses we were planning to conduct and our hypotheses about them beforehand. This should ameliorate some, though not all, concerns relating to selective publication or reporting, fishing expeditions, *p*-hacking, and various forms of so-called researcher degrees of freedom (Simmons, Nelson, & Simonsohn, 2011; Wicherts et al., 2018). Most RCTs are by now preregistered, but preregistration of hypotheses on mechanisms of change and mediation analyses have been rarer. The study also made novel contributions by being the first to compare NET to TAU among children and adolescents as well as first to include children and adolescents traumatized by family violence.

A number of limitations in our studies are also apparent. In the NET trial, mainly due to challenges in recruitment, we were not able to reach a sample quite as large as we hoped, and much data was missing. There were also a few cases where treatment was successfully implemented, but no data was collected posttreatment, which further limited the effective sample size. As a result, Studies III and IV were underpowered to detect small to medium differences between NET and TAU.

Further, in the same trial, our intention was to measure both mechanisms and symptoms a total of five times, including once during treatment, in order to examine the temporal sequence of changes in mechanisms and outcomes properly. Mid-treatment and follow-up assessments were largely unsuccessful due to challenges in data collection in this pragmatic design. In the end, due to the substantial amount of missing data at midtreatment, our mediation analyses in Study IV were only half-longitudinal (Pek & Hoyle, 2016) in that time passed between randomization to treatment and measurement of changes in mechanisms and outcomes, but these measurements of changes in mechanisms and outcomes were taken simultaneously at posttreatment. Study II was superior and truly longitudinal in this respect.

The same limitation was common in the studies we found in the review in Study I. Just a third of published controlled trials of mechanisms of change in PTSS treatment could examine whether effects on mechanisms actually took place first and then led to changes in symptoms. This is a serious limitation in our Study IV and much previous evidence on mechanisms of change in general. Examining the temporal sequence of changes is crucial to disentangling mechanisms of change from changes occurring as a result of changes in outcomes or simple side effects (Johansson & Høglend, 2007). I detailed other limitations and hidden assumptions relating to the typical linear regression approach to mediation our studies and most other studies used in Section 9.6.

The failure to collect comprehensive follow-up data as planned is a major limitation of Study III. In previous NET trials (Ertl et al., 2011; Schaal et al., 2009),

the differences between NET and control conditions have become especially clear in long-term follow-ups, as NET patients tend to continue to improve well after treatment. Inclusive follow-up data could have significantly strengthened our arguments for superiority and not just non-inferiority of NET compared with TAU. Due to a lack of notable treatment queues at participating units, we were also unable to collect waitlist type control data, except from just a few patients, and thus could not compare effects of NET or TAU to natural recovery.

More points of measurement were available for Study II. However, the analysis of trajectories of change in PTCs is limited by only including three assessments over the course of the treatment and the smaller sample consisting of only the intervention group. This number of assessments and the sample size correspond to the bare minimum for which such an analysis is meaningful.

The strict focus on RCTs in our review in Study I may be seen as a limitation for the ability of the review to provide a full picture of our current understanding of mechanisms of change in interventions for PTSS. Uncontrolled analyses can also contribute to our understanding of mechanisms of change. Even other types of studies such as naturalistic studies, experimental laboratory studies, in-depth qualitative research, or research in animal models can contribute in different ways to our emerging understanding of mechanisms of change in therapy (Kazdin, 2007). However, applying more loose criteria (as in Zalta, 2015) or a non-systematic style of review (as in Cooper et al., 2017) may also arguably obscure the level and quality of evidence available. Our review also noted great heterogeneity in the methodological quality and approach of the included studies, which makes drawing firm conclusions and comparing the results of different studies difficult. Originally, we planned to conduct meta-analytic mediation analyses for the different mechanisms, but we did not identify enough studies adequately similar to each other for any one mechanism for such an analysis to be feasible and interpretable. At least for the case negative PTCs, this is likely to change in the near future.

I should also point out some limitations relating to the measures we used. First is the fact that, apart from the guardian-rated Strengths and Difficulties Questionnaire in Study III, all measures used in our empirical studies were based on children and adolescents themselves completing self-report instruments. This may have introduced some single-informant bias towards inflated associations. Due to the use of self-report measures, all measurements apart from pretreatment assessments in Study II were also non-blinded.

The scale we used for measuring PTSS (CRIES) is a simple self-report measure that has been used in many contexts in different cultures with several translations

validated. Especially for Studies III and IV, however, a clinician-administered full diagnostic measure such the CAPS-CA (Nader et al., 1996) may have been a more appropriate and reliable choice to assess PTSS. In particular, we might have identified those children with clinical-level PTSD more reliably with such a measure. Self-report measures tend to result in higher estimates of PTSS, as compared with clinician-rated measures (Foa, Asnaani, Zang, Capaldi, & Yeh, 2018; Richardson, Frueh, & Acierno, 2010). However, the pragmatic, usual care context of the study meant all measures used had to be accessible for clinicians of various backgrounds, available in many languages, and quick and easy to use.

Somewhat puzzlingly, we found the internal consistency of the 13-item CRIES relatively poor in Study II, but rather good in Studies III and IV. All this despite Studies III and IV including children and adolescents from a variety of background and using multiple translations of the instruments, while Study II only used the better-validated Arabic translation. One explanation may be that data collection for Studies III and IV occurred during individual meetings with the clinician and possible interpreter, so participants could have asked for explanations for possibly unclear items. Questionnaires for Study II were filled in in large groups in classrooms. In the NET data, there was also some evidence of instances where a participant answered all items of the measure with the same answer, which could positively bias internal consistency estimates, especially in such a small sample. Internal consistencies for the CPTCI and TMQQ measures were good to excellent in all studies, however.

For negative PTCs, measures other than self-report have been called for (Schnyder et al., 2015), but not to my knowledge used in studies so far. Cooper et al. (2017) suggested behavioral tasks or outside, independent assessors for assessing PTCs. However, it is not clear whether outsider-rated measures of negative PTCs would be more accurate in any meaningful sense than self-reports. For other mechanisms, experimental or physiological tests, reports by family or peers/friends, or register or record-based examinations may be more feasible. Naturally, using self-report instruments limits us to studying mechanisms of change that are within the conscious awareness of our participants (Doss, 2004).

Regarding quality of traumatic memories, Bray et al. (2018) and others have noted that when we ask children and adolescents to rate the quality of their traumatic memories with measures such as the TMQQ, we are really measuring their perceptions, judgments, or beliefs about the quality of their memory. These perceptions may be quite different from the actual degree of disorganization, overly sensory nature or fragmentation of their memories, as compared with other

memories or the memories of others. However, a focus on beliefs or perceptions about memory is not necessarily a problematic focus, as its links with factors such as dissociation are quite well established (Bedard-Gilligan & Zoellner, 2012). Whether the perception and actual presence of disorganization or fragmentation in traumatic memories may be teased apart, as Bedard-Gilligan and Zoellner (2012) suggest, remains to be seen. We should, however, at least be aware of this distinction in interpreting our results.

Beyond possible limitations of self-report, the instruments we used to measure mechanisms of change admittedly operate at a rather crude level. A more nuanced approach to assessing different types of PTCs and especially separating those relating to the self and those relating to the world or reality would be prudent. Study I found that empirical research is beginning to point to self-related PTCs as possibly more important for recovery from PTSS. For Studies II and IV, sensitivity analyses where we separated these two different types of cognitions did not change the results, however.

Similarly for traumatic memories, the measure we used, the TMQQ, combines questions on problematic overly sensory and easily activated features of involuntary memories with questions on the poorly integrated, fragmented or disorganized nature of voluntary, declarative memories. Whether traumatic memories typically are less or as coherent and less or more available than other memories in PTSD is a source of on-going controversy (Brewin, 2014; 2016; 2018; Rubin, Deffler et al., 2016; Rubin et al., 2008). Especially in light of this disagreement, combining features such as coherence and organization on one hand and sensory vividness and *here and now* quality on the other into one aggregate measure may be ill-advised.

In our empirical studies II, III, and IV, and in nearly all the studies included in the review in study I, the outcomes were aggregate measures of various PTSS. Using aggregate measures of symptoms such as total sums suggests equivalent importance of different symptoms and their interchangeability. Other interpretations are certainly possible. Different symptoms may be of wildly different importance, both to the subjective well-being and mental health of trauma survivors themselves, and to the process of recovering from the effects of trauma. Such a possibility is especially highlighted by the emerging network approach to psychopathology, which views mental disorders not as latent disease mechanisms indicated by symptoms, but as being constituted by the interconnected networks of symptoms themselves (Borsboom, 2017). In such an approach, particularly central, strongly connected symptoms may be more important targets of treatment and change in them more important to recovery than peripheral, less connected symptoms, provided they are

amenable to change (Fried et al., 2018). Reducing the total cohesion of the network of symptoms may also be important. Network analytic thinking appears to suit PTSD well (McNally et al., 2015; Fried et al., 2018), and is likely to be an important avenue of research in the future.

It may also be problematic that, although our participants in studies II, III, and IV had experienced multiple traumatic events, some of the measures we used refer to *the* traumatic event. If the question arose, we instructed our participants to think of the worst or prototypical event when completing the questionnaires. A study by Priebe et al. (2018) among multiply traumatized adults suggested that defining symptoms in relation to a worst single incident as the index trauma may miss aspects of relevant symptomatology and bias interpretation of changes. The same may be true for cognitions and especially memories related to the trauma. If our participants thought of one particular event, likely the worst, in answering questions about their PTCs and traumatic memories, we might have missed important qualities of cognitions and memories related to other events. In particular, it is conceivable that the quality of traumatic memories may be quite different for different types of events. It is not self-evident that changes in the memory relating to the worst event would be most significant to recovery.

Finally, the use of observed, instead of latent variables, for both outcomes and mechanisms is another limitation of Studies II, III, and IV. In Study II, we could not identify measurement models with adequate measurement invariance, and in Studies III and IV, the small sample did not allow for use of latent variables. Using observed variables ignores measurement error. Ignored measurement error in predictors can lead to biased estimates for regression coefficients (Muthén & Asparouhov, 2015) and in mediators to downward biased estimates of indirect effects (Hoyle & Kenny, 1999).

Despite these methodological and practical limitations, I claim our studies are still able to make notable contributions. The comprehensive review in Study I provides a much needed overview of the topic of mechanisms of change and brought to light new possible mechanisms that might have been missed. Study II, methodologically the strongest, offers a rare example of systematically evaluating cognitive change in a group psychosocial intervention. The findings of Study III are immediately clinically relevant in terms of the feasibility and challenges in implementing NET, and its results add to the limited evidence base on effectiveness in usual care conditions. In Study IV, findings especially on the links between change in traumatic memories and recovery from PTSS, though tentative, provide truly novel evidence on a theoretically and clinically important, but still open question.

9.8 Clinical significance

Our findings on the safety, acceptability, and effectiveness of implementing NET among multiply traumatized children and adolescents within the Finnish healthcare system have direct clinical relevance. They lend further support to trauma-focused CBT methods being the treatment of choice for posttraumatic stress symptoms in this population as well. Our findings combined with earlier evidence continue to demonstrate that trauma-focused treatment need not be postponed or denied simply because a child or adolescent has experienced multiple traumatic events or complex trauma. Though the timing of treatment and the child's willingness to undergo trauma-focused treatment are important considerations, the added benefit of including an initial phase of stabilization and skills training prior to trauma-focused treatment remains unclear.

We found NET suitable for use in treatment within the Finnish and similar healthcare systems, especially at specialized outpatient units. Indeed, as a result of this research project, the use of NET has already spread to a number of clinics across the country. The 51 clinicians we trained in NET represent a sizeable share of mental health professionals treating multiply traumatized children and adolescents in Finland. That they are now able to use NET as part of their clinical arsenal is a significant contribution to improved clinical practice and access to evidence-based treatment.

Our results on effectiveness in treating PTSS are tentative in that we were not able to provide clear evidence for the superiority of NET as compared with TAU in Finland. The wider evidence base for NET as a whole, though, suggests a level of effectiveness that would likely be worth the relatively low costs of training clinicians in NET – at least those who are not already using other evidence-based trauma-focused treatments. However, further direct comparisons of NET to treatments already in use are called for to confirm this. In any case, it is vital that we target possible training at the right clinicians at the right level of care, particularly those regularly treating multiply traumatized people in specialized healthcare.

Our findings in Study III suggested that clinicians are sometimes wary and overly cautious about implementing trauma-focused treatment, especially treatment involving detailed exposure, with children and adolescents suffering from PTSS due to multiple trauma. In Finland, clinical training related to trauma has over the past ten years been somewhat dominated by the structural dissociation of personality theory (van der Hart, 2005; 2006). Possibly because of this trend, long, stabilizing treatments have been emphasized in clinical practice, and choices of treatment may

not have been fully in line with national and international treatment guidelines. I hope that our research contributes to convincing clinicians of the feasibility, safety, and benefits of providing evidence-based, trauma-focused treatment to those suffering from PTSS, whether due to single-incident or multiple trauma. Clinicians can be confident that provision of exposure-based treatment such as NET is currently an appropriate first-line choice for children and adolescents with clinically significant PTSS.

We found affecting the negative PTCs of children and adolescents multiply exposed to war or violence to be particularly difficult. In our studies, this may have been linked to on-going concerns related to lack of safety and predictability. In clinical practice, ensuring that traumatized child patients feel that they are safe, being adequately cared for, and provided a sense of continuity and hope may be central to facilitating change in negative PTCs, too. In particular, we must always ensure that children and adolescents do not continue to face or be exposed to violence in their life outside therapy. Study IV gives some tentative support to focusing on problematic qualities of traumatic memories when treating PTSS in clinical practice. However, we need more research before specific recommendations to this effect are wise.

Based on the findings of Study II, together with earlier analyses of this data (Diab, Peltonen, Qouta, Palosaari, & Punamäki, 2015; Qouta et al., 2012) and previous research on similar interventions (e.g., Morina et al., 2017; Tol et al., 2012; 2014), I am inclined to agree with Ertl and Neuner (2014) that we may need to reconsider widespread implementation of group-based preventive interventions that include trauma-focused elements. While such interventions may be helpful for some children, they do not appear to be very efficacious or cost effective. There are some suggestions that, at least when implemented without a triaged approach in a universal manner, they may even simultaneously exacerbate the symptomatology of a minority of children. It is possible that recovery in highly symptomatic children may be hampered, rather than promoted, by taking part in universal group interventions (Tol et al., 2014). Findings that single-session critical incident stress debriefing is not effective and may be harmful for some participants (van Emmerik, Kamphuis, Hulsboch, & Emmelkamp, 2002; McNally, Bryant, & Ehlers, 2003) should act as reminders that sharing details about a traumatic experience in a group is not always beneficial, especially soon after the trauma. As long as we have limited information about which children could benefit from group psychosocial interventions including trauma-focused elements, we should exercise great caution in implementing them. The extent to which this caution should extend to psychosocial group interventions

that include no trauma-focused elements and are more purely oriented to reducing stress and learning skills is unclear.

9.9 Directions for future research

Change in negative PTCs is established as a mechanism of change by now. However, we have little understanding on which treatments specifically would work most effectively through changes in them, and on the type or category of cognitions that we should most forcefully target. For instance, the role of self-blame in PTSS among children and adolescents is unclear. Separating specific and unstable self-blame that may promote a sense of control, relating to, e.g., making an avoidable mistake, from global, stable self-blame that suggests uncontrollability, relating to, e.g., character faults might be valuable in evaluating the role of self-blaming cognitions in recovery (Foa et al., 1989). Cooper et al. (2017) also noted that subjective sense of mastery and ability to tolerate distress are forms of belief change that have rarely been studied in a more detailed way. Including more precise measures of these types of PTCs is worthwhile in future studies. Future studies of cognitive mechanisms would also especially benefit from head-to-head comparisons between different evidence-based treatments.

Including negative PTCs as one potential mechanism of change in all future trials is justifiable, but research must also extend beyond them, especially by incorporating simultaneous analyses of several different mechanisms. Considering the strong emphasis several treatment approaches place on change in memories (Schnyder et al., 2015), more controlled research is certainly needed on problematic qualities of traumatic memories a as potential mechanism. Affecting PTSS by improvements in emotion regulation or coping strategies also continue to be worthwhile avenues of mechanism research.

In Study I and the preceding sections, I have presented recommendations on methodological and statistical practices that would improve the quality of future mechanism studies and the causal interpretation of their findings. These include careful preregistration of studies, moving to present analyses and results in the language of counterfactuals while being explicit about the assumptions made, the use of latent variables especially in mediators, and the development of better, more detailed measures of mechanisms. The issue of the temporal order of changes in mechanisms and outcomes is also absolutely crucial for mechanism research. Future studies must include an adequate number of points of measurement. Taking account

of the possibility of rapid changes especially at the start and towards the end of treatment (Kraemer et al., 2002; Owen et al., 2015) as well as sudden gains (Aderka, Appelbaum-Namdar, Shafran, & Gilboa-Schechtman, 2011; Krüger et al., 2014) during therapy also calls for more careful, repeated assessment. Arguments have also been made for tailoring points of measurement on a client-by-client basis to capture their particular trajectory of changes (Doss, 2004). Even the measures of mechanisms themselves could be individually tailored, for example to include client-specific goals. Here, we must strike a balance in future research between generalizability of results and capturing changes relevant to each particular client.

Going further, as Kazdin (2009) pointed out, mediation analyses such as those reported on here, even if all conditions for making causal inferences are fulfilled, are really just the first level in understanding the mechanisms of therapeutic interventions. In searching for and testing mediators, we are really operating at the level of *why*, and there still remains the difficult task of explaining *how*, for instance, earlier changes in cognitions lead to later changes in symptoms. Here, I have limited myself to psychological mechanisms of change, as analyses at that level are likely to be directly useful for clinical practice and testing clinically oriented theories. For elucidating the precise chain of proximal causes relating, e.g., cognitions to symptom change, analyses at neuroscientific and biological levels may be more appropriate.

Even though trauma-focused treatments are effective in treating PTSS among both adults (Cussack et al., 2016) and children and adolescents (Gillies et al., 2016), they often, as in our Study III, fail to be significantly superior to TAU or other active control conditions. In many treatments, drop-out rates are also relatively high (Imel et al., 2013) and a significant share of participants are left with debilitating symptoms despite receiving gold-standard treatment. Even in the most successful trials such as that of Jensen et al. (2014) for TF-CBT, a fifth of participants fail to recover from PTSD. Treatment resistant PTSD is not uncommon. Our treatments are clearly not good enough.

Head-to-head comparisons of different active treatments are rare, especially among children and adolescents. In particular, comparing NET with TF-CBT could be especially worthwhile to understand whether cognitive elements and techniques (a) contribute added effectiveness to treatment, or (b) improve acceptability of treatment and compliance (Weisman & Rodebaugh, 2018). Such comparisons might also identify groups of children and adolescent who would especially require or benefit from more cognitively-oriented treatment. Dismantling studies examining the importance of particular treatment elements or implementing them in different order are also called for. For example, Weisman and Rodebaugh (2018) suggest that

it might be optimal to time cognitive interventions so that they would not reduce harm expectancy before exposure and thus the possibility of expectancy violation during exposure. However, empirical evidence of such a timing effect is lacking.

Better understanding of mechanisms of change may help us refine existing treatments. Head-to-head comparisons and dismantling studies may allow us to target them better. Improving dissemination and reducing clinician concerns about evidence-based exposure treatment can improve access to treatment. Still, entirely new treatments, whether supplementary or alternative are probably also called for, especially for treatment resistant forms of PTSD.

Some evidence is available for the effectiveness of mindfulness-based interventions for PTSS (Boyd et al., 2018; Hopwood & Schutte, 2017), and we found tentative evidence in Study I on the specific role of increases in mindfulness in these effects. Consequently, high-quality trials comparing mindfulness-based and trauma-focused interventions with each other or studying the effects of adding a mindfulness-based component to existing treatments could be especially valuable. The suitability and effectiveness of non-traumafocused metacognitive therapy for treating PTSS among children and adolescents should also be further explored (Simons & Kursawe, 2019). Employing virtual reality technologies for exposure treatment of PTSD is another promising avenue of research, with some pilot studies showing good results, mostly among adult veterans (Botella, Serrano, Baños, & García-Palacios, 2015; Maples-Keller, Yasinski, Manjin, & Rothbaum, 2017).

Further, the possibility of improving the efficacy of psychological and especially exposure-based treatment of PTSD by pharmacological means, such as administration of d-cycloserine or oxytocin, has been of interest to researchers for a number of years (Flanagan, Sippel, Wahlquist, Moran-Santa Maria, & Back, 2018; Olff, Langeland, Witteveen, & Denys, 2010; Otto et al., 2016). Trials of propranolol augmentation also continue, with some successes (Brunet et al., 2018). A most promising recent development in this area involves the combination of 3,4-methylenedioxymethamphetamine (MDMA), an empathogenic stimulant, and psychotherapy, termed MDMA-assisted psychotherapy (Mithoefer, 2017; Thal & Lommen, 2018). After promising results from six initial RCTs, worldwide clinical trials are now on-going for MDMA-assisted psychotherapy for PTSD among adults (Mithoefer et al., 2019). Understandably, even greater care must accompany the trialing of psychopharmacological approaches to treating children or adolescents. However, considering that other amphetamines are in widespread long-term use for the treatment of attention deficit hyperactivity disorder among children and adolescents (Chan, Fogler, & Hammerness, 2016; Punja et al., 2016), there should

be no fundamental barrier to trialing approaches such as MDMA-assisted psychotherapy at least among adolescents in the future as well.

9.10 Conclusions

Fifteen years ago, Qouta and El Sarraj (2004) noted the "tragic fact that Israeli and Palestinian children have become laboratories for the study of the relationship between trauma and violence, conflict, and children's well-being during war" (p. 11). As important as such research is, it really should not be needed. Prevention is always preferable to treatment, and especially so in the case of children and adolescents traumatized by exposure to war or conflict. It is impossible to overstate the importance of peace for global well-being and mental health, including that of children and adolescents currently living in conflict areas. Similarly, our first priority should of course be to prevent violence within the family, whether through promoting positive parenting and supporting parental mental health, better recognition of risk factors such as mild punitive violence before it escalates, high-quality primary care, or active child protective measures.

However, if prevention fails, and children and adolescents are traumatized by exposure to war or violence, it is at least somewhat encouraging that treatment approaches exist that are able to help most children suffering from posttraumatic stress symptoms. The findings of this dissertation for their part add to the understanding that trauma-focused treatment including exposure is safe, feasible and effective for children and adolescents multiply traumatized by exposure to war or violence. Convincing clinicians to get trained in and use existing evidence-based treatments in their daily clinical work is crucial.

Further refinement and better targeting of trauma-focused treatment would benefit from understanding their underlying mechanisms of change. This dissertation showed that evidence has accumulated of changing the negative appraisals traumatized children and adolescents may have of themselves as weak, incapable or permanently changed for the worse and of the world as inherently dangerous and unpredictable as one key to amelioration of symptoms. Many types of treatment can achieve such changes, and we do not yet know whether certain particular treatments might do so more effectively among specific groups of children. Our studies suggest that, perhaps due to on-going concerns of safety, predictability and continuity, effecting changes in such cognitions among children and adolescents multiply traumatized by war or violence is more challenging.

Findings on other psychological mechanisms of change through which we can affect posttraumatic stress symptoms among children are so far limited.

As Brewin (2003) pointed out, the subject of trauma and trauma-related mental health symptoms arouse particularly strong passions and can polarize opinions among clinicians and researchers alike. The best remedy is to ensure that our understanding of trauma, its effects on survivors and the treatment of trauma-related symptoms is grounded in robust psychological science. Emerging best practices in open and transparent science, such as careful preregistration, separation between hypothesis-generating and hypothesis-testing approaches, and open data can assist us in answering this challenge. I have attempted to provide other suggestions to improve future research. The findings of our studies here already contribute to an emerging evidence base on mechanisms of change involved in treating posttraumatic stress symptoms, so that our thinking on mechanisms, too, could be based not just on theory and clinical expertise, but also empirical evidence. As clinicians and researchers, we owe it to those affected by traumatic events to provide them with the highest level of timely, evidence-based, effective care possible.

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Psychosocial group intervention among war-affected children: An analysis of changes in posttraumatic cognitions

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Psychosocial Group Intervention Among War-Affected Children: An Analysis of Changes in Posttraumatic Cognitions

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Cognitive theories point to reduction in dysfunctional posttraumatic cognitions (PTCs) as one mechanism involved in recovery from posttraumatic stress symptoms (PTSS), yet research findings have shown individual differences in the recovery process. We tested the cognitive mediation hypothesis above in a previously published psychosocial group intervention among war-affected children. We also examined heterogeneity in children's PTCs during the intervention. We used a cluster randomized trial of Smith et al.'s (2002) teaching recovery techniques (TRT) intervention among 482 Palestinians 10–13 years of age ($n = 242$ for intervention group, $n = 240$ for control group). Children reported PTSS, PTCs, and depressive symptoms at baseline, midpoint, postintervention, and at 6-month follow-up. Path analysis results showed that TRT was not effective in reducing dysfunctional PTCs, and the reductions did not mediate intervention effects on PTSS. Using latent class growth analysis, we chose the model with 3 differing trajectories in the intervention group: high, decreasing, moderate, downward trending, and severe, stable levels of PTCs. Higher PTSS and depressive symptoms at baseline were associated with membership in the severe, stable trajectory. The intervention did not produce the kind of beneficial cognitive change needed in the cognitive mediation conceptualization. Nevertheless, cognitive changes differed substantially across children during the intervention, and were associated with their preintervention mental health status. These findings call for more detailed examination of the process of cognitive mediation.

Millions of children are subject to grave violations of their fundamental human rights under conditions of war or armed conflict. Although many children show great resilience in the face of trauma, many develop long-lasting emotional disturbances as well. A review among war-affected children ($N =$ 7,920) showed that of severely exposed children, nearly half (47%) had posttraumatic stress disorder (PTSD), 43% suffered from depression, and 27% had anxiety disorders (Attanayake et al., 2009). A number of psychosocial group interventions have been created and implemented to alleviate the posttraumatic symptoms of war-affected children. Some of these interventions appear to be helpful (e.g., Jordans et al., 2010; Layne et al., 2008), but few rigorous studies on their effectiveness are available, and they have shown mixed results (Jordans, Pigott, & Tol, 2016; Peltonen & Punamäki, 2010). It is still to a large extent unclear how and in which conditions psychosocial group interventions work.

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To understand how interventions can lead to positive mental health outcomes, we need to study their effective treatment components and underlying mechanisms of change (Kazdin, 2007; Zalta, 2015). Cognitive theories of PTSD propose that functional changes in posttraumatic cognitions (PTCs) are central to successful recovery after trauma (Ehlers & Clark, 2000; Rauch & Foa, 2006). Increasing evidence suggests that reductions in dysfunctional PTCs drive improvements in posttraumatic stress symptoms (PTSS) among adult trauma survivors in individual cognitive–behavioral therapies (Kleim et al., 2013; Zalta et al., 2014). We tested this cognitive mediation hypothesis (McLean, Yehuda, Rosenfield, & Foa, 2015) for a group-based psychosocial intervention, teaching recovery techniques (TRT), among Palestinian children exposed to war trauma.

Psychosocial group interventions in warzones are typically applied to all exposed children (Peltonen & Punamäki, 2010). In contrast, targeted interventions for the most vulnerable have been recommended by others (Jordans et al., 2010; Tol et al., 2010). To understand what works for whom, we should learn about differential processes of change and recovery during interventions for children with different resources and vulnerabilities. Accordingly, we also sought to identify differing trajectories of PTCs among children participating in the TRT intervention and tested whether exposure to war trauma and preintervention mental health was related to such trajectories.

Several models of PTSD point to the importance of thoughts, attributions, and appraisals in the development and maintenance of the disorder (Ehlers & Clark, 2000; Rauch & Foa, 2006). The cognitive model of Ehlers and Clark (2000) suggests that PTSS become persistent when survivors process the trauma in a way leading to a sense of serious, current when there is not such threat. The dysfunctional processing involves excessively negative appraisals of the trauma, harmful behavioral and cognitive strategies (e.g., avoidance or rumination), and a narrowed trauma-dominant time perspective.

According to emotional processing theory (Foa & Kozak, 1986; Rauch & Foa, 2006), failed attempts to deal with extreme trauma lead to pathological psychological fear structures that link previously safe objects and even pleasant events to meanings of fear and danger. Survivors continue to rely on responses that might have been adaptive during trauma exposure, but prevent recovery by biasing current experience and causing feelings of helplessness.

Cognitive models of PTSD are valid for children, too (Hitchcock, Ellis, Williamson, & Nixon, 2015; Stallard & Smith, 2007). There is ample evidence that PTCs predict later and concurrent PTSS among children (Ehlers, Mayou, & Bryant, 2003; McKinnon et al., 2016; Ponnamperuma & Nicolson, 2016). PTCs were also found to mediate between acute and chronic PTSS in one study (Meiser-Stedman, Dalgleish, Glucksman, Yule, & Smith, 2009), though not in two others (Liu & Chen, 2015; Palosaari, Punamäki, Diab, & Qouta, 2013).

Research among adults reveals heterogeneous paths in recovery from trauma, with evidence for trajectories of gradual, drastic, or delayed improvement, as well as chronic PTSD (Bonanno & Mancini, 2010; Hobfoll, Mancini, Hall, Canetti, & Bonanno, 2011). Two studies have also examined mental health trajectories among children exposed to military violence and war (Betancourt, McBain, Newnham, & Brennan, 2013; Punamäki, Palosaari, Diab, Peltonen, & Qouta, 2015), suggesting trajectories of symptom recovery, resistance to symptoms, and symptom increase.

Some studies have further analyzed the correlates of trajectories of recovery among trauma-affected children (e.g., Le Brocque, Hendrikz, & Kenardy, 2010; Punamäki et al., 2015). These studies, however, have focused on PTSS, with no studies available on correlates of trajectories of cognitive change, nor studies among war-affected children taking part in interventions.

Forms of cognitive–behavioral therapy (CBT) focusing on the traumatic event are the primary treatment for PTSD recommended for both adults and children (American Psychiatric Association, 2004; Australian Centre for Posttraumatic Mental Health, 2013). Evidence for the efficacy of CBT exists for children exposed to sexual and physical abuse or single-incident trauma (Gillies, Taylor, Gray, O'Brien, & D'Abrew, 2012; MacDonald et al., 2012).

Evidence on the suitability and effectiveness of standard CBT treatments for war-affected children is limited. Moreover, the need for mental health support in warzones is often extensive, and the provision of individualized care challenging or downright impossible (Yule, Dyregrov, Raundalen, & Smith, 2013). Therefore, a number of psychosocial group interventions have been developed to help children and their families in conditions of war. They typically address trauma-related symptoms and many also incorporate CBT components such as restructuring of maladaptive cognitions, desensitization to traumatic memories, and psychoeducation (Peltonen & Punamäki, 2010).

Psychosocial group interventions among war-affected children have demonstrated some positive effects in alleviating trauma-related symptoms of depression (Bolton et al., 2007), aggression (Jordans et al., 2010) and PTSD (Layne et al., 2008; O'Callaghan, McMullen, Shannon, & Raferty, 2015; Qouta, Palosaari, Diab, & Punamäki, 2012). Yet, effect sizes have overall been moderate (Jordans et al., 2016; Peltonen & Punamäki, 2010). Moreover, treatment effects have often been specific to gender and age (Bolton et al., 2007; Jordans et al., 2010; Qouta et al., 2012; Tol et al., 2010), or social and family-related factors (Tol et al., 2010, 2014).

According to cognitive theories, success or failure in improving dysfunctional PTCs could explain these discrepant outcomes. Reductions in negative cognitions have indeed been found to mediate PTSS reduction in individual CBT-based treatments for adults and adolescents (Kleim et al., 2013; McLean et al., 2015; Zalta et al., 2014). We were unable to identify studies on psychosocial group interventions decreasing dysfunctional PTCs or on the mediating role of improved PTCs among war-affected children. Accordingly, we sought to test whether a psychosocial group intervention for war-affected children (TRT; Smith, Dyregrov, & Yule, 2002) could also have a positive effect on PTCs, and whether this in turn could drive PTSS recovery.

The TRT intervention focuses on children's PTSS across a minimum of five sessions: two dealing with intrusive memories, thoughts, and feelings; one with psychological overarousal; and two with avoidance and exposure. Treatment elements include normalization of stress reactions, psychoeducation, and symbolic and dream work, as well as relaxation techniques and exposure via visualization and creative methods.

TRT has been found effective in reducing children's PTSS after natural disasters (Giannopoulou, Dikaiakou, & Yule, 2006; Pityaratstian et al., 2015). TRT was also effective in reducing PTSS, depression, and traumatic grief among war-affected Palestinian children in the West Bank (Barron, Abdullah, & Smith, 2012). Yet, among Palestinian children in Gaza, TRT could only reduce the proportion of clinical-level PTSD among boys and among girls with low levels of peritraumatic dissociation (Qouta et al., 2012). No studies of which we are aware have yet examined the effects of TRT on PTCs.

This secondary analysis of the TRT trial (Qouta et al., 2012) studied the role of PTCs in the intervention targeting PTSD among Palestinian children. First, it examined whether reductions in PTSS were mediated by changes in PTCs. We hypothesized (a) that participation in the TRT intervention would lead to greater reductions in dysfunctional PTCs than in a waiting-list

comparison group, and (b) the greater reduction in dysfunctional PTCs would have a statistically significant mediating role in reducing PTSS. Possible gender differences in these links were also examined.

Second, as an exploratory analysis, we aimed to identify trajectories of PTCs among children participating in the TRT intervention. The trajectories would capture significant individual differences in the level of and change in PTCs across baseline, midintervention, and postintervention. Third, we examined whether participants' gender, age, and severity of war trauma, as well as preintervention depressive or PTSS was associated with trajectory membership.

Method

Participants and Procedure

The following describes what was done in the original (Qouta et al., 2012) trial reported their age, gender, number of siblings, and place of residency. Parents reported their education and employment status. All instruments were used in Arabic translations. An Arabic version of the CRIES was already available. For the other instruments, a bilingual psychologist translated them form English to Arabic, and a back translation was conducted to check for accuracy.

The participants were 482 Palestinian students from the Gaza Strip, Palestine (240 boys and 242 girls, 10–13 years of age; $M = 11.29$, $SD = 0.68$). Four schools were randomly sampled from a list of government schools. For each school, two female and two male classes were randomly sampled, with one of each then randomly assigned to the intervention group and the other to the waiting-list group. The TRT intervention group had 242 participants and the control group 240, both with equal gender distribution.

All students took part in a baseline assessment in April 2009, 3 months after the Gaza war of 2008–2009 (T1), at the end of the intervention (T3), and 6 months after it (T4). In addition, students in the TRT group were assessed at the midpoint of the intervention (T2). There were no dropouts between T1 and T3, but 78 (16.2%) students dropped out between T3 and T4. Dropouts did not significantly differ from others in intervention versus control group status, age, and mental health variables or parental education, income, or work status. Significantly more boys (22.5% of total sample) than girls (9.2%), however, dropped out. A possible reason may be that more boys sought work opportunities due to postwar economic hardship.

There were no differences in demographic variables between the intervention and control groups. Of fathers, 26.2% had polytechnic and 24.4% university education, whereas 8.0% of mothers had a university and 39.8% polytechnic education. Yet, unemployment was high among fathers (48.3%) and almost all mothers (93.2%) worked at home, the shares corresponding to statistics on Gaza (United Nations Office for the Coordination of Humanitarian Affairs, 2009). Most families (85.5%) lived in urban areas, 11.2% in refugee camps, and 3.3% in villages, and families had 6.24 children on average. The students reported exposure to an average of five types of traumatic war events: 71.8% had witnessed a violent death, 23.8% the injury or beating of a family member, and 35.9% had been injured themselves.

There were no significant differences between the intervention and control groups in baseline levels of PTCs or depressive symptoms. Students in the control group, however, had significantly less PTSS at baseline ($M = 27.78$, $SD = 10.63$) compared with the intervention group ($M = 32.78$, $SD = 9.58$), despite having experienced slightly more traumatic war events (control group: $M = 5.28$, $SD = 2.55$; intervention group: $M = 4.62$, $SD = 2.94$). Table 1 shows the levels of PTCs and PTSS at each timepoint for both groups.

The ethical boards at the Ministry of Education and Gaza Community Mental Health Programme reviewed and accepted the study protocol and measurements. Permission for the intervention and study were received from school authorities. Information sheets were prepared for the students and their parents explained the purpose of the study. Verbal consent to participate was obtained. The students' questionnaire data were collected in the school classes by six research assistants. The third author (S.Q.) supervised the data collection through weekly sessions and school visits. Participants, parents, teachers, and research assistants were unaware of the intervention status of the students at baseline.

The TRT (Smith et al., 2002) intervention was based on the Arabic language manual with slight culturally sensitive modifications, including more emphasis on dream work over two extra sessions, meeting the parents of the students during one extra session, and a different timing for the safe place exercise. Trained counselors carried out the intervention as an extracurricular activity with 15 students in each group over eight sessions lasting 2 hours twice a week (for further details, see Qouta et al., 2012). After T4, the waiting-list control group received the same intervention.

Program fidelity was addressed by a senior member of the research group holding weekly supervisory sessions with the counselors carrying out the intervention.

Measures

The 13-item Children's Revised Impact of Event Scale (CRIES; Smith, Perrin, Dyregrov, & Yule, 2003) was used to measure PTSS. Construct and criterion validity of the CRIES has been demonstrated (Perrin et al., 2005), and it has shown good psychometric properties among war-affected children and adolescents 9–14 years of age (Barron et al., 2012; Smith et al., 2003). Students evaluated on a 4-point scale (0 = *not at all*, 1 = *rarely*, 3 = *sometimes*, 5 = *often*) how often they had experienced each symptom over the last 2 weeks. Sum variables were constructed for T1 and T4, with Cronbach's $\alpha = .64$ at T1 and $\alpha = .61$ at T4.

The Children's Post-Traumatic Cognitions Inventory (CPTCI; Meiser-Stedman, Smith, et al., 2009) was used to measure posttraumatic cognitions. The CPTCI has been found reliable and valid in several different samples of children

Table 1
Means and Standard Deviations for Dysfunctional Posttraumatic Cognitions and Posttraumatic Stress Symptoms

	T1				T2		T3				T4			
	Intervention ($n = 242$)		Control ($n = 240$)		Intervention ($n = 211$)		Intervention ($n = 242$)		Control ($n = 240$)		Intervention ($n = 207$)		Control ($n = 197$)	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
CPTCI	54.95	12.28	55.15	11.49	53.33	12.25	52.22	11.50	50.75	11.76	51.97	10.84	51.32	12.81
CRIES	32.78	9.59	27.79	10.63	27.90	10.55	25.92	11.05	27.41	11.61	24.28	9.82	25.83	9.24

Note. T1 = baseline; T2 = midintervention; T3 = postintervention; T4 = 6-month follow-up; CPTCI = Children's Post-Traumatic Cognitions Inventory; CRIES = Children's Revised Impact of Event Scale.

and young people 6–18 years of age (de Haan, Petermann, Meiser-Stedman, & Goldbeck, 2016; Diehle, de Roos, Meiser-Stedman, Boer, & Lindauer, 2015). Students used a 4-point scale to indicate their agreement with 25 statements since the scary event (1 = *don't agree at all*, 2 = *don't agree a bit*, 3 = *agree a bit*, 4 = *agree a lot*). Sum variables were constructed for T1, T2, T3, and T4; the α values were .85, .86, .87, and .87, respectively.

The Depression Self-Rating Scale for Children (DSRS; Birleson, 1981) was used to measure depression. This self-report scale consists of 18 statements that students evaluated on a 3-point scale (0 = *mostly*, 1 = *sometimes*, 2 = *never*) based on how they had felt during the last week. A sum variable was constructed for T1, with α = .66.

A checklist of possible traumatic events relating to the 2008–2009 Gaza war was used to measure exposure to war trauma. Students reported if they had experienced each type of event. A sum variable was calculated for the number of positive answers on 14 items fitting the definition of a traumatic event according to the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; *DSM-IV-TR*; American Psychiatric Association, 2000).

Data Analysis

To estimate the effects of the intervention on PTCs at T3 and T4, CPTCI sum scores at T3 and T4 were regressed on the intervention as a dummy variable, using mean-centered baseline (T1) values. To examine possible gender differences in the intervention's effect on PTCs, the Wald test was used to test equality constraints for regression coefficients for boys and girls.

Based on the correlation matrix for the variables, a maximum likelihood path analysis model was constructed to estimate the possible mediating effect of changes in PTCs in PTSS reduction. For estimating the indirect effect of the intervention on PTSS at T4 via PTCs at T3 in the path analysis model, we employed the product of coefficients method with a Taylor series approximation for the standard error (*SE*) of the product (MacKinnon et al., 2002).

Within the TRT intervention group, latent class growth analysis (LCGA; Berlin, Parra, & Williams, 2014) was conducted to examine whether meaningful trajectories could be identified in the participating students' PTCs during the intervention. Linear LCGA models with different numbers of latent trajectories were estimated to account for the level of PTCs at T1, T2, and T3. Selection of the best-fitting model was based on the Bayesian information criterion (BIC) and the bootstrap likelihood ratio test (BLRT; Nylund, Asparouhov, & Muthén, 2007). Multinomial logistic regression was used to examine whether child gender, age, PTSS, or depressive symptoms at T1, or war trauma were associated with most likely trajectory membership (Clark & Muthén, 2009).

Cluster sampling can lead to nonindependence of observations and unrealistically small estimates of population *SE*s. To account for these effects, a form of Kish correction was used, in which the *SE*s of regression weights were multiplied by the square root of the design effect.

We tested two latent measurement models for PTSS: The first was based on the three subscales (intrusion, avoidance, and arousal) originally suggested for the CRIES-13 (Perrin, Meiser-Stedman, & Smith, 2005), and the second represented the four factors (intrusion, avoidance, hyperarousal, and dysphoria), identified by Simms, Watson, and Doebbeling (2002). Results showed that the 4-parcel model had better, acceptable fit initially ($\chi^2 = 57.52$, $df = 38$, $p = .002$; comparative fit index

Table 2
Correlations Between PTCs, PTSS, and Intervention Group Status

Variable	1	2	3	4
1. T1 PTCs	–			
2. T3 PTCs	.39***	–		
3. T1 PTSS	.37***	.21***	–	
4. T4 PTSS	.17**	.30***	.14**	–
5. Intervention	−.01	.06	.24***	−.08

Note. $N = 482$, except due to dropout; $n = 404$ for correlations with posttraumatic stress symptoms at T4. T1 = baseline; PTCs = posttraumatic cognitions; T3 = postintervention; T4 = 6-month follow-up; PTSS = posttraumatic stress symptoms.
**$p < .01$. ***$p < .001$.

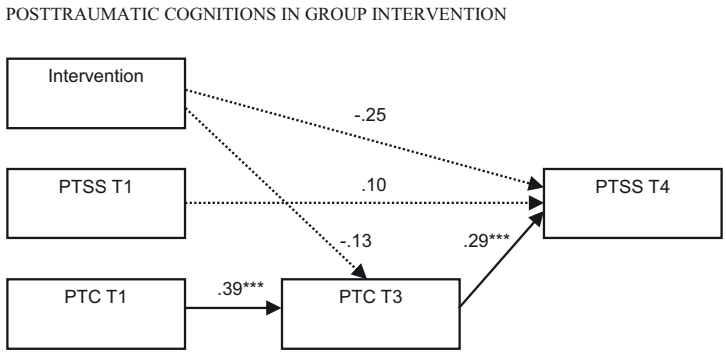

Figure 1. $N = 482$. Path analysis model of potential intervention effects on posttraumatic stress symptoms at T4 via posttraumatic cognitions at T3. Standardized β coefficients. Solid (dotted) lines indicate significant (nonsignificant) paths. PTSS = posttraumatic stress symptoms; PTC = posttraumatic cognitions; T1 = baseline; T3 = postintervention; T4 = 6-month follow-up. *$p < .05$. **$p < .01$. ***$p < .001$.

[CFI] = .94; Tucker-Lewis index [TLI] = .91; root mean square error of approximation [RMSEA] = .05). However, in this measurement model, setting factor loadings equal between the control and intervention groups resulted in significant worsening of fit according to the Satorra-Bentler scaled χ^2 difference test for multiple linear regression estimation (scaled χ^2 difference = 20.96, $df = 6$, $p = .002$). Thus, measurement invariance between the control and intervention groups could not be established, and this latent variable model could not be used for comparing the intervention's effects on PTSS. Total scores on the CRIES were used instead.

We also tested two measurement models for posttraumatic cognitions. The first was based on the original Posttraumatic Cognitions Inventory for adults (PTCI; Foa, Ehlers, Clark, Tolin, & Orsillo, 1999), suggesting two parcels of cognitions about the self and cognitions about the world, and the other on the 2-factor structure suggested for the CPTCI (Meiser-Stedman et al., 2009). The first model had good initial fit ($\chi^2 = 22.56$, $df = 14$, $p = .068$; CFI = .99; TLI = .97; RMSEA = .05), and factor loadings could be constrained equal between the control and intervention groups, as well as temporally invariant. Constraining parcel intercepts equal between the control and intervention groups resulted in significant worsening of fit (scaled χ^2 difference = 29.56, $df = 3$, $p < .001$). Thus, strong measurement invariance between the control and intervention groups could not be established, and this latent variable model could not be used for comparing the intervention's effects on posttraumatic cognitions. Total scores on the CPTCI were used instead.

To account for the effects of the cluster sampling method, namely possible nonindependence of observations and unrealistically small estimates of population *SE*s, a form of Kish correction was used as suggested by Ukoumunne et al. (1999). In this correction, the *SE*s of regression weights in all regression-based analyses were multiplied by the square root of the design effect, $1 + (n - 1) * ICCx * ICCy$, where *ICCx* is the intraclass correlation coefficient (ICC) of the covariate or predictor variable, *ICCy* the intraclass correlation coefficient of the dependent variable, and *n* the average size of the clusters, here, the number of children in each school class providing data.

All analyses were carried out using Mplus 7.3 (Muthén & Muthén, 1998–2015) and full information maximum likelihood estimation with robust *SE*s. This approach handles missing data without excluding dropouts and adjusts *SE*s for possible nonnormality in the variables.

Results

For T1, data on traumatic war experiences were missing for 49 students (10.2%). At T2, data on PTCs were missing for 31 participants (12.8%). There were no individual data points missing for the studied variables at T3 or T4.

When adjusting for the effect of PTCs at T1, linear regression indicated no significant effect of the intervention on PTCs at T3, β = .13, 95% confidence interval (CI) [−.09, .36]; or T4, β = .05, 95% CI [−.22, .33]. The Wald test indicated no significant gender differences in the regression coefficients of the effect of the intervention on PTCs at T3 or T4.

The path analysis model, presented in Figure 1, had an excellent fit, $\chi^2(2) = 1.45$, $p = .485$; RMSEA = 0.00, CFI 1.00, standardized root mean square residual = 0.012, to the data and explained 11% of the variance in PTSS at T4 ($R^2 = .11$). In the path analysis model, the level of PTCs at T3 had a significant effect on PTSS at T4, β = .29, 95% CI [.20, .38], when adjusting for levels of PTSS at T1, with no significant gender difference. There was no significant indirect (mediated) effect, however, from participation in the intervention on PTSS at T4 via PTCs at T3, mediated effect = .04, 95% CI [−.04, .11].

The results of LCGA modeling for the intervention group are presented in Table 3. The BIC and BLRT both found that the 3-class model had the best fit. The 3-class model had

Table 3
Results of Latent Class Growth Analysis of Posttraumatic Cognition Trajectories

Class	AIC	BIC	adj BIC	VLMR	LMR	BLRT	Counts[a]	Entropy
1	5431.96	5449.40	5433.55	–	–	–	–	–
2	5327.46	5355.38	5330.02	.00	.00	.00	159, 83	.70
3	5302.33	5340.71	5305.84	.08	.09	.00	161, 67, 14	.78
4	5301.99	5350.84	5306.46	.28	.29	.67	23, 154, 2, 63	.79
5	5299.95	5359.26	5305.37	.15	.16	.05	28, 139, 3, 39, 33	.74

Note. $n = 240$. AIC = Akaike information criterion; BIC = Bayesian information criterion; adj BIC = sample-size adjusted BIC; VLMR = p value for Vuong-Lo-Mendell-Rubin likelihood ratio test; LMR = p value for Lo-Mendell-Rubin adjusted likelihood ratio test; BLRT = p value for bootstrapped parametric likelihood ratio test.
[a]Final class counts based on most likely latent class membership.

empirically interpretable, reasonably distinct trajectory classes with acceptable entropy (.78). The estimates for the trajectory of the CPTCI scores at T1, T2, and T3 are presented in Figure 2.

The high, decreasing levels trajectory was the most likely class for two thirds ($n = 161$; 66.5%) of students in the intervention group. It was characterized by a high level of dysfunctional PTCs (intercept = 58.36, $SE = 1.33$) with a statistically significant, though modest, decrease in them over the course of the intervention (slope = −1.49, $SE = 0.55$, $p = .006$; estimate at T2 = 56.87, T3 = 55.38).

The moderate, downward trending trajectory involved more than a quarter ($n = 67$; 27.7%) of students in the TRT intervention. This trajectory had average levels of dysfunctional PTCs (intercept = 44.28, $SE = 1.54$) with a decreasing trend in them during the intervention (slope = −2.08, $SE = 1.14$, $p = .068$; estimate at T2 = 42.20, at T3 = 40.12).

The severe, stable levels trajectory was the smallest trajectory, as 5.8% ($n = 14$) of students belonged to it. This trajectory had very high levels of dysfunctional PTCs (intercept = 66.73, $SE = 4.59$), with a nonsignificant increase in them during the intervention (slope = 3.29, $SE = 2.64$, $p = .212$; estimate at T2 = 70.02, at T3 = 73.31).

Multinomial logistic regression indicated that depression, PTSS, and war experiences at T1 were significantly associated with trajectory membership. Students with higher depression or PTSS scores at T1 were more likely to belong to the trajectory of severe, stable levels of PTCs than to the trajectory of high, decreasing levels of PTCs: for a one unit increase, depression: odds ratio (OR) = 1.18, 95% CI [1.07, 1.30], and for PTSS: $OR = 1.16$, 95% CI [1.09, 1.23]; or to the moderate, downward trending trajectory, depression: $OR = 1.35$, 95% CI [1.18, 1.55], and for PTSS: $OR = 1.18$, 95% CI [1.10, 1.26]. Further, more traumatic war experiences and depressive symptoms at T1 was associated with membership in the high, decreasing levels trajectory as compared to the moderate, downward trending trajectory, $OR = 1.24$, 95% CI [1.08, 1.41], and $OR = 1.14$, 95% CI [1.04, 1.25], respectively. Neither gender nor age was associated with membership in any trajectory.

Discussion

Our results indicated that the TRT intervention was not effective in improving children's dysfunctional PTCs. No mediating role of beneficial changes in PTCs in reducing PTSS could thus be found. This stands in contrast to studies where change in PTCs was found to be a significant mechanism of change in several CBT-based PTSD treatments among adults and adolescents exposed to nonwar trauma (Kleim et al., 2013; McLean et al., 2015; Zalta et al., 2014). Still, even here, earlier levels of PTCs did predict later PTSS, which as such agrees with the cognitive mediation hypothesis.

A closer look at the levels of and changes in PTCs in the intervention group revealed notable heterogeneity, presenting as trajectories of high initial but decreasing levels of dysfunctional PTCs, moderate and downward trending, and very high, stable levels of dysfunctional PTCs across the intervention. It appears TRT did not lead to improvements in cognitions for children exhibiting severe preintervention mental health problems, which was associated with membership in the severe, stable dysfunctional PTCs trajectory.

The inability of the TRT intervention to improve children's dysfunctional trauma-related cognitions may be a reflection of the insufficiency or inappropriateness of group psychosocial interventions among severely traumatized children. The participating Palestinian children had experienced life threats, destruction, and horror in the context of a major war. It may be that the length and nature of the intervention was not sufficient to provide a sense of safety for these children who continued to live in unresolved political conflict. The proximity of life-endangering events may have interfered with successfully reworking dysfunctional cognitions, for example, through alternative appraisals, nonbiased perceptions, and new consoling meanings. Further, some of the PTCs that are considered maladaptive in safe conditions could be realistic to some extent—even adaptive in dangerous circumstances, such as a perception of the world as unpredictable and inherently dangerous. If that is the case, interventions that aim to modify these cognitions may be a misfit, at least for children most affected by the unsafe conditions. It would be necessary to replicate these results

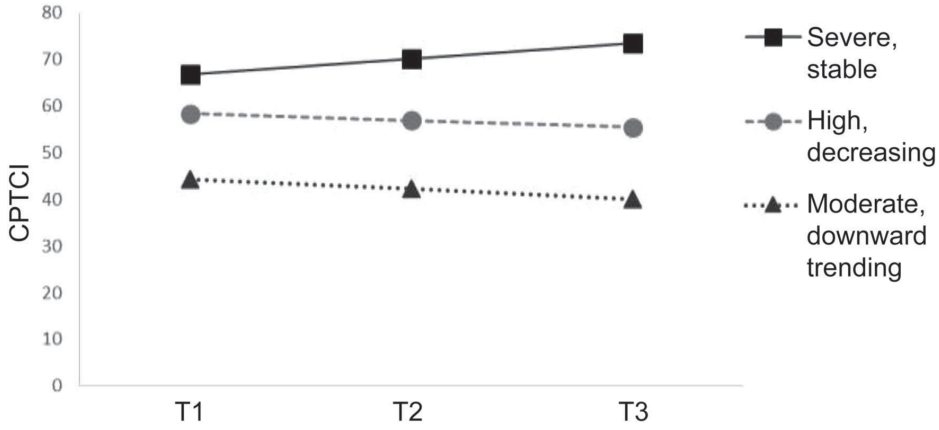

Figure 2. $n = 240$. Identified latent trajectories of PTCs for a 3-trajectory latent class growth model. Estimated total scores for each trajectory at three timepoints. CPTCI = Children's Post-Traumatic Cognitions Inventory; T1 = baseline; T2 = midintervention; T3 = postintervention.

under safer circumstances to learn more about the adaptive versus pathological roles of PTCs in general and in psychosocial interventions among war-affected children in particular.

The authors of TRT note that very severely traumatized children would also need other forms of help, and that TRT is not designed to treat complex pathological cases (Smith et al., 2002; Yule et al., 2013). In some psychosocial interventions, children with significant comorbid psychopathology have been excluded (Giannopoulou et al., 2006; Layne et al., 2008). Excluding children with complex symptomatology, however, has also been criticized for limiting their chances to benefit from interventions (Stallard, 2006), as well as for skewing results (Bradley, Greene, Russ, Dutra, & Westen, 2005). The present study on TRT focused on war-affected children without screening for the severity of their trauma exposure or mental health status beforehand. This approach may be criticized as more tailoring in intervention delivery has recently been recommended (Jordans et al., 2016) and because these results cannot be generalized to war-affected children with less-severe experiences.

Indeed, the findings on unique trajectories in children's PTCs during the intervention lend support to demands of targeting and tailoring interventions according to children's specific needs. Although small in size (6%), the trajectory of severe, stable levels of dysfunctional PTCs, is worrying. Higher initial depressive and PTSS characterized these children who had very severe levels of dysfunctional PTCs that showed no decrease and even a nonsignificant increase during the intervention. The findings are partly in line with earlier studies demonstrating links between depression and dysfunctional PTCs in children (Diehle et al., 2015; Leeson & Nixon, 2011; Liu & Chen, 2015). One explanation may be that rumination and negative pretrauma schemas typical to depression can lead to inflexible processing of trauma (Liu & Chen, 2015). Depressed children may also find it more difficult to engage in group interventions and therefore experience less cognitive benefits.

The other trajectories identified are also informative. The most common trajectory of high, decreasing levels of PTCs represents children who initially exhibited very dysfunctional cognitions, but managed to somewhat improve their appraisals of themselves as more mastering, of the world as a safer place, and of others as more benevolent. Interestingly, higher exposure to war trauma was associated with membership in that trajectory, and may explain their higher initial levels of dysfunctional PTCs. Children with more depressive symptoms were also more likely to belong to this trajectory, as compared to the smaller moderate, downward trending trajectory, again in line with some earlier studies (Leeson & Nixon, 2011; Liu & Chen, 2015). As far as we know, this was the first study to examine heterogeneity in trajectories of PTCs during psychosocial treatment among children. Based on these preliminary results, this approach can be recommended for further study, preferably with larger samples, and more points of measurement.

Previous research on intervention effectiveness among war-affected children has shown significant gender differences (Bolton et al., 2007; Jordans et al., 2010; Qouta et al., 2012). Here, child gender was not associated with levels of negative PTCs or the intervention's effects on them. This finding is in line with an earlier study among trauma-exposed Sri Lankan children (Ponnamperuma & Nicolson, 2016), but stands in contrast to results from combined community and clinical samples from the Netherlands and the United Kingdom, where girls showed significantly higher levels of dysfunctional PTCs (Diehle et al., 2015; Meiser-Stedman et al., 2009).

The study has several limitations. First, despite random sampling, the control group had less PTSS at baseline compared with the intervention group. Possible explanations for this difference include cluster randomization and the rather low reliability of the CRIES in this sample. Second, as a multilevel analysis was not tenable, a Kish correction was applied to account for the effects of cluster sampling, but this approach is

not optimal (Musca et al., 2011). Third, only linear, short-term change in PTCs was modeled in the LCGA, and direct comparison to the control group was not possible. Hence, the change in PTCs in some trajectories cannot be considered an effect of the intervention per se. Retesting with the same instrument (the CPTCI) at such short intervals could also be criticized. As regards the intervention itself, the slight modifications made to extend the program can be criticized, as well as the lack of systematic assessment of program fidelity, for example, by a log book. Finally, it is possible that TRT exerted some effectiveness through other mechanisms of change, such as reductions in physiological arousal or improved peer relations, which were not considered here.

Researchers have called for stronger separation between low-level universal prevention and selective interventions directly targeted at reducing PTSS (e.g., Tol et al., 2010). In warzones, there are insufficient human and economic resources for the provision of mental health interventions (Moss et al., 2006), and group-based psychosocial interventions are typically the practical first-line choice. Our current and earlier (Qouta et al., 2012) results suggest that an intervention like TRT may not be enough to help all affected children with their PTSS in challenging postwar settings, and that one reason for this may be inability to effect cognitive change. Investigating how and in which conditions such interventions do work continues to be of great practical and ethical importance.

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PUBLICATION III

Treating children and adolescents with multiple traumas: a randomized clinical trial of narrative exposure therapy

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CLINICAL RESEARCH ARTICLE

Treating children and adolescents with multiple traumas: a randomized clinical trial of narrative exposure therapy

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ABSTRACT

Background and Objective: Millions of children and adolescents worldwide suffer from post-traumatic stress disorder (PTSD) and other problems due to prolonged exposure to traumatizing events. Forms of cognitive-behavioural therapy are the most commonly used treatment for PTSD, but evidence from sophisticated studies in clinical settings among children is limited.

Method: This multicentre, parallel, non-blinded, pragmatic randomized controlled trial assessed the effectiveness of narrative exposure therapy (NET) in traumatized children and adolescents. Fifty 9–17-year-old participants, who had experienced prolonged traumatic conditions in the form of refugeedom or family violence and suffered from PTSD symptoms, were randomized into NET (n = 29) and treatment as usual (TAU; n = 21) active control groups. The objective was to determine whether NET can be feasibly implemented within the existing healthcare system of a high-income country and whether it would reduce mental health problems, especially PTSD, and increase resilience, in children and adolescents with multiple traumas more effectively than TAU. We hypothesized that NET would be more effective than TAU in reducing symptoms and increasing resilience.

Results: Analysis of variance revealed that PTSD and psychological distress, but not depression symptoms, decreased regardless of treatment group. Resilience increased in both groups. Within-group analyses showed that the decrease in PTSD symptoms was significant in the NET group only. The effect sizes were large in NET but small in TAU. Concerning PTSD symptom cut-off scores, the reduction in the share of participants with clinical-level PTSD was significant in the NET group only. Intention-to-treat analyses using linear mixed models confirmed these results.

Conclusions: Despite its shortcomings, this study gives preliminary support for the safety, effectiveness, and usefulness of NET among multiply traumatized children and adolescents in clinical settings. Close attention must be paid to the implementation of the new intervention as an everyday tool in healthcare.

Tratando a niños y adolescentes con múltiples traumas- un estudio clínico randomizado de terapia de exposición narrativa

Antecedentes y Objetivo: Millones de niños y adolescentes en todo el mundo sufren de trastorno de Estrés Postraumático (TEPT) y otros problemas debido a exposición prolongada a eventos traumáticos. Formas de terapia cognitivo-conductual son las más comúnmente usadas para tratar el TEPT, pero evidencias con diseños sofisticados con niños en ambientes clínicos son limitados.

Métodos: Condujimos un estudio multicéntrico, paralelo, no ciego, pragmático aleatoriamente controlado y estudiamos la efectividad de la Terapia de Exposición Narrativa (NET) en niños y adolescentes traumatizados. Un total de 50 participantes entre 9 y 17 años, quienes habían experimentado condiciones traumáticas prolongadas como refugiados o violencia familiar y sufrido de síntomas de TEPT, fueron puestos en forma aleatoria en grupos de NET (n= 29) y tratamiento usual como control (TAU por sus siglas en inglés; n= 21). El objetivo del estudio era encontrar si la NET puede ser implementada de manera factible en el sistema de salud existente de un país de altos ingresos y si puede reducir los problemas de salud mental, especialmente TEPT, y aumentar la resiliencia, en niños y adolescentes con múltiples traumas más efectivamente que el TAU. Nuestra hipótesis era que la NET sería más efectiva en reducir los síntomas y aumentaría más la resiliencia que el TAU.

Resultados: los resultados ANOVA revelaron que el TEPT y la angustia psicológica, pero no los síntomas depresivos, disminuyeron sin importar el grupo en el cual fueron tratados. La resiliencia aumentó en ambos grupos. Los análisis intra-grupo mostraron que hubo una disminución significativa en los síntomas de TEPT solo en el grupo de la NET. Los tamaños del efecto fueron grandes en la NET, pero pequeños en el TAU. En lo que concierne a los síntomas de TEPT los puntos de corte, una reducción en la proporción de participantes con un nivel clínico de TEPT fue significativa sólo en el grupo de NET. El análisis de con la intención de tratar empleando modelos lineales mixtos confirmó estos resultados.

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关键词
难民; 虐待; 儿童; 青少年; 叙事暴露疗法; 创伤后应激障碍

HIGHLIGHTS

- Narrative exposure therapy (NET) is a safe and useful method for treating children with multiple violence-related traumas.
- Intrusive symptoms may be more effectively treated with NET than with non-exposure-based methods.
- Close attention must be paid to the implementation of new interventions for trauma-related symptoms as everyday tools in typical healthcare settings.

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Conclusiones: A pesar de las limitaciones del estudio actual, nos da un apoyo preliminar para la seguridad, efectividad y utilidad de la NET entre múltiples niños y adolescentes traumatizados en ambientes clínicos. Se deberá prestar mucha atención a la implementación de la nueva intervención como una herramienta del día a día en el sistema de salud.

治疗多发创伤的儿童和青少年 - 叙事曝光治疗的随机临床试验

背景和目标： 全世界上百万的儿童和青少年患有创伤后应激障碍（PTSD）和长期接触创伤事件导致的其他问题。认知行为疗法是PTSD最常用的治疗形式，但设计成熟的儿童临床情境提供的证据还尚有限。
方法：我们进行了一项多中心、平行、非盲法（ non-blinded）、务实的随机对照试验，并研究了叙事暴露疗法（NET）在创伤儿童和青少年中的有效性。总共50名9-17岁的被试，他们经历了避难所或家庭里的暴力，在经历长期创伤性疾病后患有PTSD症状。 被试被随机分入NET（n = 29）和照常治疗主动控制（TAU; n = 21）组。该研究的目的是考查NET是否可以在高收入国家的现有医疗保健系统中切实可行地实施，以及是否能够比TAU更有效地帮助多发创伤的儿童青少年减少心理健康问题（尤其是创伤后应激障碍），并提高韧性。我们假设NET比TAU更有效地减轻症状和增加弹性。
结果：ANOVA结果显示，不论哪个治疗组，PTSD和心理痛苦有所减轻，但抑郁症状不变。两组的恢复力均有所提高。组内分析显示，仅在NET组中PTSD症状的减少是显著的。 NET的效果大小很大，但TAU的效果很小。考虑PTSD症状临界分，仅在NET组中临床PTSD被试比例的降低是显著的。使用线性混合模型的治疗意向分析（Intention-to-treat analyses）证实了这些结果。
结论：尽管本研究存在缺陷，但它为NET在临床环境中对多发创伤儿童和青少年群体中的安全性、有效性和可用性提供了初步支持。我们必须密切关注这种新干预措施作为医疗保健日常工具的使用情况。

1. Introduction

Exposure to multiple traumas during childhood is a major challenge for mental health throughout the lifespan. In particular, a strong association between violence-related traumatic events and post-traumatic symptoms has been established (Evans, Davies, & DiLillo, 2008; Johnson & Thompson, 2008). Findings on the prevalence of post-traumatic stress disorder (PTSD) among refugee children have varied between 19% and 54% (for a review, see Bornstein & Montgomery, 2011). Rates as high as 37% and 65% were found in studies among children and adolescents resettled into high-income countries (Buchmüller, Lembcke, Busch, Kumsta, & Leyendecker, 2018; Gandham, Gunasekera, Isaacs, & Britton, 2017). At the same time, a great number of children living in high-income countries are exposed to family violence, and 13–50% of them suffer from PTSD (Rossman, Hughes, & Rosenberg, 2000). This study included children and adolescents exposed to violence either in war or refugeedom or within the family.

For traumatized children and adolescents in general, cognitive-behavioural therapy (CBT), especially its trauma-focused forms, has been repeatedly found to be effective in reducing PTSD and other mental health symptoms (Gillies, Taylor, Gray, O'Brien, & D'Abrew, 2012; Stallard, 2006). A review by de Arellano et al. (2014) showed that the most studied intervention package, trauma-focused cognitive behavioural therapy (TF-CBT), is indeed able to reduce symptoms of PTSD. The TF-CBT method has mainly been studied among sexually abused children, with both active control groups and waiting-list control groups.

Narrative exposure therapy (NET) is also based on CBT principles but its development has been influenced by exposure-based and testimonial therapies (Schauer, Neuner, & Elbert, 2011). It is a manualized, individual, short-term intervention programme for the treatment of PTSD resulting from exposure to organized violence or other repeated traumatic events. When treating children and adolescents with multiple traumas, it may be important not only to tackle one event in their traumatic history, but to process all events that still cause PTSD symptoms (Mørkved et al., 2014; Mørkved & Thorp, 2018; Schauer et al., 2011). The clinical model of repeated traumatization underlying NET draws on (1) dual representation theories of PTSD (Brewin, Dalgleish, & Josep, 1996; Brewin, 2014) and (2) emotional processing theory and the idea of fear networks (Foa, Hupper, & Cahill, 2006). KIDNET is a child-friendly version with some adaptations to the original model to help children to construct their story and express their emotions (Schauer, Neuner, & Elbert, 2017).

Although good evidence on the effectiveness of NET already exists for adults (McPherson, 2012; Robjant & Fazel, 2010), only four trials are available among children and adolescents: one for refugee children and adolescents in Germany (Ruf et al., 2010), one among former child soldiers in Uganda, including also young adults (Ertl, Pfeiffer, Schauer, Elbert, & Neuner, 2011), one among Sri Lankan adolescents affected by both war and a natural disaster (Catani et al., 2009), and one among Rwandan genocide orphans (Schaal, Elbert, & Neuner, 2009). The only trial with refugee children in a high-income country did not include an active control group and none of the earlier studies was conducted as a pragmatic clinical trial (PCT), where intervention delivery and participant

follow-up would be closely aligned with usual care in order to understand the real-world implications of the intervention (Thorpe et al., 2009; Zwarenstein et al., 2008). None of the earlier studies included children exposed exclusively to family violence, even though they had often experienced multiple traumatization.

Among adults, a single pragmatic trial exists on the effectiveness of NET versus treatment as usual (TAU) among adult refugees and asylum seekers (Halvorsen, Stenmark, Neuner & Nordahl, 2014). It showed the superiority of NET in treating PTSD symptoms over TAU, although symptoms decreased in both groups. A clear gap exists in understanding the effectiveness of NET as part of everyday clinical work among multiply traumatized children. We aimed to contribute to the field by conducting a PCT in the context of the existing healthcare system of a high-income country.

In this study, we ask: (1) Can NET be feasibly implemented within the existing healthcare system of a high-income country (Finland)? (2) Does NET reduce (a) PTSD symptoms, (b) depressive symptoms, or (c) psychological distress, or improve (d) resilience in children and adolescents with multiple traumas more effectively than TAU? We hypothesize that NET is more effective than TAU in reducing the symptoms and increasing resilience.

2. Method

2.1. Design and procedure

We carried out a multicentre, parallel-group, randomized, controlled pragmatic trial comparing NET to TAU at several treatment units located around Finland. This study was registered at ClinicalTrials.gov (NCT02425280) before data collection started and the study protocol was published beforehand (Kangaslampi, Garoff & Peltonen, 2015). Since publication of the protocol, the study was extended to also include participants suffering from violence in the family. Other changes that were necessary to the protocol during the study are noted later. This paper presents findings on the primary outcomes described in the study protocol.

Participants' mental health was assessed before and after the 3 month intervention period as well as 3 months after the intervention ended. Unfortunately, the very limited data gathered at follow-up prevented their use in primary analyses of effectiveness. However, these data were utilized in intention-to-treat analyses.

A total of 51 experienced mental health professionals were trained to use NET and recruited as therapists. With 51 trained therapists, we aimed at 80 participants to be recruited for the study, taking into account dropouts. The goal was to include units responsible for children's and adolescents' trauma treatment at all levels (primary, secondary, and specialized units). The therapists also acted as assessors, collecting data from the patient they were treating largely in the same way as they would assess the patient's symptoms and effects of treatment in general. In other words, the researchers were involved in the treatment practice as little as possible.

A 3 day NET training was organized in three consecutive years (2014–2016). The recruitment took place between January 2015 and June 2017. The data collection started in January 2015 and ended in February 2018. To maintain NET skills, the trained therapists participated in tailored peer-group meetings organized within their own units as the interventions proceeded. When conducting TAU, therapists received the usual work counselling which is statutory in psychiatric work in Finland.

NET consisted of seven to 10 weekly sessions lasting for 90 minutes each. Treatment length could be adjusted, but was advised not to exceed 10 sessions. NET was conducted according to the manual as outlined by Schauer, Neuner & Elbert (2011) and translated into Finnish (Peltonen, 2015). With younger participants, the treatment included elements from KIDNET with creative elements, especially as part of the lifeline construction (Schauer, Neuner & Elbert, 2017). The purpose of this pragmatic trial was to study the NET method as a part of everyday clinical practice, implemented in the existing healthcare framework, thus reflecting typical, not necessarily ideal or perfect, use of the method. However, treatment adherence and competence was monitored and ensured through (1) group supervision, where all cases were reviewed and discussed, (2) a self-report questionnaire, where the therapists had to report the patient's life events that had been part of the intervention, and (3) use of the Subjective Units of Distress Scale (SUDS) administered to the client to ensure that exposure really took place during sessions where it was intended to happen. No major deviations from the NET protocol as described by Schauer et al. (2011) were identified.

In the TAU condition, the therapists were instructed to use any intervention that they would normally use. No specific instructions were given as to what TAU should entail, apart from not including elements specific to NET. No extra resources were added to the usual care settings to implement the interventions. The TAU varied in intensity from weekly to monthly meetings, reflecting the typical level of care provided by each unit. The session duration varied between 45 and 90 minutes, and treatment was delivered by a single therapist (excluding network meetings). Based on information gathered through a self-report questionnaire, TAU mainly consisted of the following components (in order of prevalence): (1) network meetings with the child's family and involved professionals (such as social workers and teachers); (2) discussions about current problems and life situations such as sleep difficulties,

problems related to the asylum procedure, and practical matters; (3) psychosocial support and monitoring; and (4) family therapeutic sessions. One TAU case was reported to include one session of exposure to a traumatic event.

The ethical boards of the Pirkanmaa Hospital District, Tampere City Welfare Services, the Helsinki Diaconess Institute, and the Hospital District of Southwest Finland approved the study. Age-specific brochures with information about the study were given to the participants and their parents. Written consent was requested from both parents or guardians and the participants themselves.

2.2. Participants

The sample consisted of 50 participants recruited among the patients and clients of the participating clinics. The participants were between 9 and 17 years of age (mean age 13.2, *SD* = 3.2), who attended NET or TAU for post-traumatic stress symptoms. Boys made up slightly more than half (58%) of the sample. Three-quarters of the participants were refugees or asylum seekers (n = 37) and one-quarter were Finnish children and adolescents with experiences of family violence (n = 13). The refugee children and adolescents were from Iraq (n = 14), Afghanistan (n = 14), and various other countries (from other Middle Eastern countries and from African countries, n = 9).

The inclusion criteria were: (1) 9–17 years of age; (2) exposure to violence either in war or refugeedom or within the family; (3) the child being referred to a participating clinic because of trauma symptoms; and (4) active post-traumatic stress symptoms, as confirmed by the therapist at the participating unit based on his or her evaluation and the Children's Revised Impact of Event Scale (CRIES) (Horowitz, 1986; Smith, Perrin, Dyregrov, & Yule, 2003). All children and adolescents were subjected to a clinical evaluation, but a diagnosis of PTSD was not necessary for participation in the study. The exclusion criteria were: (1) psychotic disorders; (2) current severe substance abuse; (3) severe suicidal ideations; and (4) intellectual disability. Four adolescents declined to participate. Three of them were unaccompanied minors, who were sceptical about the confidentiality of the research even though it was explained to them, and for one child, the parents were hesitant to start treatment at all.

2.3. Randomization

Each participant was randomized into one of two groups. One group received NET, acting as the study group, and the other group, receiving TAU, acted as a positive control group. The trial was parallel group in nature.

At the start of the study, before any participants were recruited, the participating clinics were provided with folders by the research group, each containing all the relevant research material, questionnaires, and measurements for one participant. A sealed, opaque envelope was placed by the research team in each folder with a piece of paper inside. Half of these papers were marked 'NET' and the other half 'TAU'. Each trained therapist was provided with two folders, one for NET and one for TAU, forming an allocation ratio of 1:1 (Schulz & Grimes, 2002). Whenever a child was identified as a potential participant by a clinician at one of the cooperating units, information concerning the intervention and the related research was provided both to the participant and to his or her parents. If they were willing to participate in the research, informed consent was requested from the child and his or her parents. The envelope was then to be opened and its content would determine whether the participant received NET or TAU. However, as Figure 1 shows, the final distribution to NET and TAU groups was not even. This was due to difficulties in the planned recruitment procedure of participants. One-third of the trained therapists could not find any eligible patients to participate in the study and 41% recruited one participant instead of two. Irregularities in the randomization process were not identified, but cannot be completely ruled out as additional explanations for the imbalance.

Two out of 10 dropouts were Finnish children with a background of family violence, while the others had a refugee background. Dropouts were due to discontinuation of treatment in seven cases. Of those, one participant belonged to the TAU and six to the NET group. The reason for dropout in six cases was either the child's/adolescent's or his or her parents' decision not to continue the treatment because they felt that the treatment was no longer needed (in all cases the therapists had a different opinion). Only one NET client reported that it was too hard to go through the traumatic events and wanted to quit. Three NET cases are further considered as dropouts in the absence of collected post-test data, although they completed the treatment.

2.4. Measures

In line with PCT principles, the measurement tools were selected so that they could be easily employed as part of the therapists' everyday practice. Most of the measures were already in use in participating clinics before the study. All therapists were familiar with administering self-report questionnaires prior to the study, and the importance of not interfering when the children were filling the questionnaires was emphasized when training the therapists. All measures were either already available in the most common

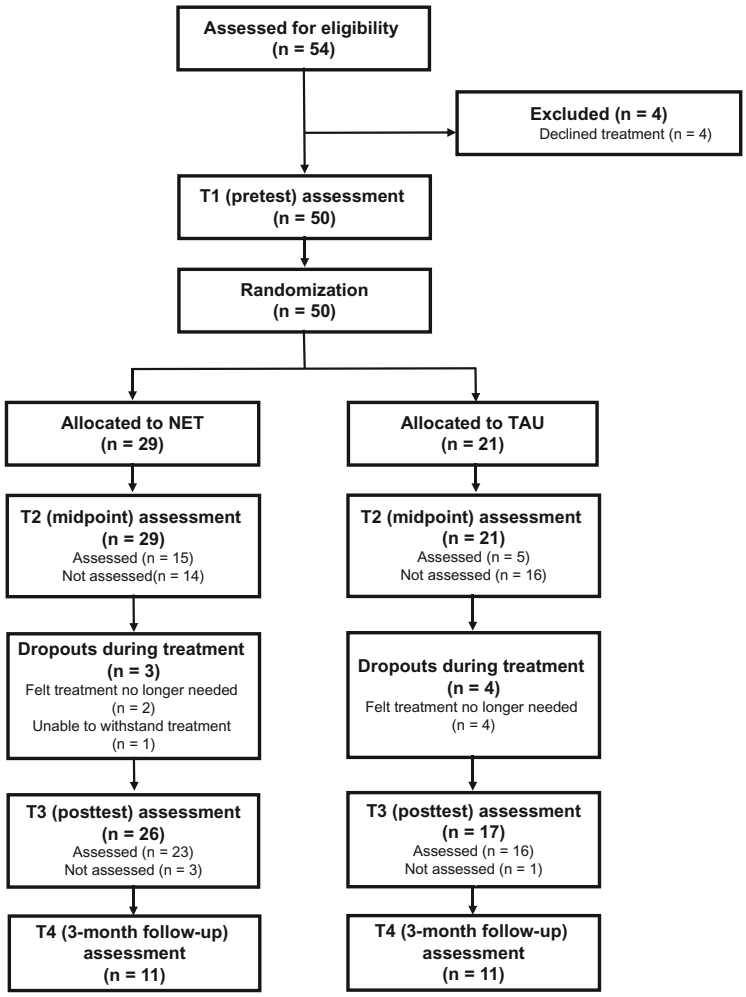

Figure 1. Adapted CONsolidated Standards of Reporting Trials (CONSORT) flow diagram of data collection. NET, narrative exposure therapy; TAU, treatment as usual.

languages spoken by the participants (Finnish, English, Dari, Sorani, and Arabic), or translated into these languages as part of this study. For those participants who did not speak any of these languages, an interpreter read out the questions and response alternatives to them.

2.4.1. Traumatic experiences

Exposure to traumatic experiences was measured by checklists capturing typical violent and traumatic events during war or refugeedom (nine items) and violence in the family (nine items). The checklists were prepared for the purposes of this study but were based on the Event Checklist for War, Detention, and Torture Experiences (Schauer et al., 2011), the Child and Adolescent Intake Form of the Center for Victims of Torture, and adverse childhood experiences studies (Dong et al., 2004; Duke, Pettingell, McMorris, & Borowsky, 2010).

2.4.2. PTSD

PTSD symptoms were measured at T1 (pretest), T2 (midway), T3 (post-test), and T4 (follow-up), using the children's version of the Revised Impact of Event Scale (CRIES) (Horowitz, 1986; Smith et al., 2003). CRIES consists of 13 items covering the re-experiencing, avoidance, and hyperarousal symptom dimensions. Participants estimate the occurrence of each symptom on a four-point scale (0 = not at all, 1 = rarely, 3 = sometimes, 5 = often). CRIES has been found to have good reliability among war-affected children and adolescents (Smith et al., 2003). In this study, the PTSD Total score, together with the subscales of Intrusions, Avoidance, and

Arousal, was used. In addition, the cut-off score of 17, calculated from the Intrusions and Avoidance subscales, was used as a measurement of high probability of obtaining a diagnosis of PTSD, as recommended by Smith et al. (2003). Because the questions in the CRIES refer to a certain traumatic event, and participants in our sample had been exposed to many events, they were advised to think about the worst or most disturbing event in their trauma history when answering the questionnaire. The reliabilities were α = .81 at pretest and α = .86 at post-test for the PTSD Total score, α = .64 at pretest and α = .83 at post-test for Intrusions, α = .74 at pretest and α = .80 at post-test for Avoidance, and α = .76 at pretest and α = .83 at post-test for Arousal.

2.4.3. Depression

Depressive symptoms were measured at T1, T3, and T4, using the Depression Self-Rating Scale for Children (DSRS) (Birleson, Hudson, Buchanan, & Wolff, 1987). The measure includes 18 items that assess the cognitive, affective, and behavioural dimensions of depression. For each item, participants estimate on a three-point scale whether they have experienced the symptom over the preceding 2 weeks (0 = not at all, 1 = sometimes, 2 = all the time). The reliabilities were α = .89 at pretest and α = .89 at post-test.

2.4.4. Resilience

Resilience was assessed using a questionnaire measuring individual resilience among war-traumatized children, developed for this study, at T1, T3, and T4. It was used after considering a well-validated Child and Youth Resilience Measure (CYRM) (Ungar & Liebenberg, 2011), but finding some of its items difficult for the target group. The questionnaire consists of 10 items measuring the positive individual resources of children and adolescents (e.g. 'I have a skill which I am particularly good at'; 'I feel that I am important to someone'). Participants evaluated on a three-point scale how well the description fit them (0 = not at all, 1 = somewhat, 2 = yes, fits well). Reliability was estimated at α = .89 at pretest and α = .75 at post-test.

2.4.5. Psychological distress

Psychological distress (child and guardian-rated) was measured using the Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997). A total score composed of emotional, behavioural, and relational problems, as well as hyperactivity, was used, as suggested by Goodman (1997). Each of the dimensions consists of five items rated on a three-point scale on how well the description fits the participants (0 = not at all, 1 = somewhat, 2 = yes, fits well). Reliability was α = .82 for children's self-reports and α = .81 for parents' reports at pretest, and α = .76 for children's self-reports and α = .83 for parents' reports at post-test.

2.4.6. Life changes during therapy

To take into account the possible effects of life changes occurring during therapy, we asked at post-test whether participants had had negative or positive changes in living arrangements after the intervention had started.

2.5. Statistical analyses

Two sets of analyses were carried out: first, an analysis of changes from pretest to post-test with treatment completers for whom data on symptoms were available at T3, and, secondly, intention-to-treat analyses employing all available data (T1, T2, T3, and T4). In the first and primary analysis, repeated measures analyses of variance (ANOVA) in SPSS 24 were used, with time as a two-level within-subject variable and treatment as a two-level between-subjects variable for PTSD symptom Total score and its subscales (Intrusion, Avoidance, and Arousal), as well as for depression symptoms, resilience, and psychological distress. To compare the clinical significance of symptom reduction, we used the cut-off score of 17 for the Avoidance and Intrusion subscales combined, and explored the share of participants who recovered from clinical-level PTSD to levels below this cut-off during the treatments they received. For this, we used related samples McNemar tests for both groups (NET and TAU) with pretest and post-test data of actual treatment completers.

For intention-to-treat analyses, we used linear mixed-effects modelling with the nlme package (Pinheiro, Bates, DebRoy, Sarkar, & Core Team, 2018) in R 3.4.3 (R Core Team, 2017), employing all available data from all points of measurement. The effect of time was modelled as weeks elapsed since the pretest assessment, and time × treatment interactions were examined for evidence of dissimilar treatment effects. Improvements in model fit were indicated by the Akaike information criteria and likelihood ratio tests, and 95% confidence intervals (CIs) were computed for particular effects. Visual inspection of residual plots showed no evidence of heteroscedasticity or significant deviation from normality.

A total of 34 individual item-level responses were missing from otherwise completed measures. These individual missing values were replaced by the response closest to that participant's mean answer to other questions of the measure. Otherwise, owing to the pragmatic nature of the trial, only partial measurements were available for a large minority of participants. T1 measurements were available on PTSD symptoms for 47 participants, on depressive symptoms for 34 participants, on resilience for 41 participants, on self-evaluated psychological distress for 33 participants, and on guardian-evaluated psychological distress for 28 participants. At the T2 time-

point used only for intention-to-treat analyses, PTSD symptoms were assessed for 19 participants. At T3, measurements were available as follows: PTSD symptoms, 38 participants; depressive symptoms, 25 participants; resilience, 26 participants; self-evaluated psychological distress, 21 participants; and guardian-evaluated psychological distress, 21 participants. Finally, at T4, measurements were available as follows: PTSD symptoms, 20 participants; depressive symptoms, 17 participants; resilience, 14 participants; self-evaluated psychological distress, 12 participants; and guardian-evaluated psychological distress, 13 participants. Little's test indicated that data were missing at random in T1 and T3 [$\chi^2(214) = 208.83$, $p = .587$].

3. Results

3.1. Implementation

Out of 51 trained therapists, 35 (67%) contributed data to the study. This means that 33% of trained therapists could not find an eligible patient to participate in the study over the 1–3 year (depending on the training date) recruitment period. Only four patients refused to participate in the study. The aim was that every therapist would recruit two participants, one for NET and one for TAU, in random order. This was achieved by 59% of the contributing therapists, while 41% of them recruited one participant (allocated randomly to NET or TAU). The biggest obstacle expressed for recruiting participants was problems deciding on the timing of trauma treatment overall. In many cases, therapists considered that the child would not be ready to be exposed to his or her trauma history (which would be part of the treatment if allocated to NET) and it was therefore not possible to recruit the child to the study. Thus, in practice, additional exclusion criteria began to be applied by the therapists during the study.

Interpreters were used in 73% ($n = 22$) of cases with children of refugee background, and were present during all assessments and treatment. With one exception, the same interpreter worked with the same child in all NET or TAU sessions. The quality of interpretation varied, according to the professionals' reports, but was at a satisfactory or good level at all times.

The majority of the interventions were conducted at outpatient clinics by psychologists and psychiatric nurses. Treatment fidelity among participating clinicians was good and no major deviations from the NET protocol described by Schauer et al. (2005) were identified. Tables 1 and 2 describe the included units, the number of trained therapists at each level, with information on their educational background, as well as the number of professionals who eventually started either the NET or a TAU intervention with their clients.

Table 1. Number of therapists trained, as well as interventions started and completed at different types of treatment units.

Unit	Therapists trained	Interventions started	Interventions completed
Primary healthcare	10	4	4
Specialized healthcare: outpatient clinics	27	30	24
Specialized healthcare: inpatient clinic	4	0	0
Third sector (trauma unit)	7	10	6
Housing unit	3	6	5
Total	**51**	**50**	**39**

Table 2. Number of therapists trained, as well as interventions started and completed, by occupation of therapist.

Occupation	Therapists trained	Interventions started	Interventions completed
Psychiatric nurse	13	16	14
Social worker	4	3	2
Psychologist	29	24	16
Psychiatrist	5	7	7
Total	**51**	**50**	**39**

3.2. Descriptive statistics

A minority (23% and 30%) of participants in both groups were Finnish children with a background of family violence, while the other participants had a refugee background. The vast majority (over 80%) of children in both groups had received psychiatric care before the current intervention. As confirmed by χ^2 tests and *t* tests, there were no systematic group differences in any of the sociodemographic characteristics, or in baseline levels of the outcome variables (Table 3).

As Table 4 shows, exposure to violence was massive among the participants. Over 80% of participants with a refugee background had experienced violence by an unknown person and over 20% of them physical abuse by their caretakers. Over 70% of family members of refugee participants had experienced violence and/or torture, and for 35% of them a family member had been killed. Finnish children with a family violence background had experiences of physical (100%), psychological (70%), and sexual (46%) violence. None of the children was experiencing violence at the time of the study.

Exploration of the possible effects of life changes occurring during therapy showed that two participants in the NET group had had negative and one had had positive changes in living arrangements after

Table 3. Demographic variables and baseline levels of mental health variables for all randomized participants.

Demographic variables	NET (n = 30) N (%) M (SD)	TAU (n = 20) N (%) M (SD)	Difference
Gender			ns
Girl	12 (40%)	9 (45%)	
Boy	18 (60%)	11 (55%)	
Age	13.4 (2.7)	13.0 (3.3)	ns
Country of origin			ns
Finland	7 (23%)	6 (30%)	
Afghanistan	8 (27%)	6 (30%)	
Iraq	8 (27%)	6 (30%)	
Other	6 (20%)	3 (10%)	
Previous psychiatric treatment (yes)	25 (83%)	17 (85%)	ns
Post-traumatic stress symptoms	38.0 (14.3)	37.0 (13.0)	ns
Depressive symptoms	14.0 (9.0)	12.9 (4.8)	ns
Psychological distress, self-evaluated	14.2 (7.2)	15.8 (5.3)	ns
Psychological distress, guardian-evaluated	17.1 (7.7)	17.4 (6.6)	ns
Resilience	14.1 (4.8)	13.2 (4.5)	ns

NET, narrative exposure therapy; TAU, treatment as usual; ns, no significant difference at $p < .05$, according to t test. Post-traumatic stress symptoms were measured with the Children's Revised Impact of Event Scale (theoretical range 0–65). Depressive symptoms were measured by the Depression Self-Rating Scale for Children (theoretical range 0–36). Psychological distress was measured by the Strengths and Difficulties Questionnaire Total Difficulties scale (theoretical range 0–40). Resilience was measured by a custom 10-item measure (theoretical range 0–20).

Table 4. Exposure to different types of traumatic events for children with refugee or family violence backgrounds.

Traumatic event	Refugee (n = 37)	Family violence (n = 13)
Stayed at refugee camp	6 (16%)	
Been imprisoned or held in enclosed space against will	13 (35%)	
Experienced violence by a stranger	30 (81%)	
Family members imprisoned or taken away against their will	17 (46%)	
Family members experienced violence or been tortured	27 (73%)	
Family members died due to armed conflict	13 (35%)	
Family members injured due to armed conflict	9 (24%)	
Been separated from family members due to armed conflict	20 (54%)	
Family members missing	13 (35%)	
Experienced physical abuse by caretakers	21 (57%)	13 (100%)
Experienced psychological abuse by caretakers	20 (54%)	9 (69%)
Experienced sexual abuse by caretakers	7 (19%)	6 (46%)
Neglected	10 (27%)	7 (54%)

the intervention started. Other participants reported no changes.

3.3. Effectiveness

3.3.1. Short-term effects among treatment completers

Table 5 shows the levels of all primary outcomes at T1 and T3, the mean change in them, and effect sizes. ANOVA results, presented in Tables 6 and 7, indicated a significant main effect of time for PTSD Total score [$F(1,35) = 12.93$, $p < .001$], as well as for the subscales of Intrusions [$F(1,35) = 21.77$, $p < .001$] and Arousal [$F(1,35) = 8.16$, $p = .007$], but not for Avoidance. As presented in Table 6, the main effect of time was also significant for psychological distress reported by the child [$F(1,18) = 4.97$, $p < .039$] and the guardian [$F(1,17) = 5.94$, $p < .026$], as well as for resilience [$F(1,23) = 5.14$, $p < .033$], but not for depression. The main effects of group and time × treatment interaction were not significant for any of the outcome variables.

We conducted further within-group analyses for PTSD symptoms, as the interventions were specifically targeted to trauma. They showed that the decrease in symptoms was significant for all PTSD symptom scales excluding Avoidance in NET, but not in the TAU group, and the effect sizes were large in NET, but small in TAU [NET: for PTSD Total score, $t(20) = 3.79$, $p < .01$, Cohen's $d_z = 0.83$; for Intrusions, $t(20) = 5.17$; $p < .001$, $d_z = 1.13$; for Avoidance, $t(20) = 1.56$, p = .13, $d_z = 0.34$; for Arousal $t(20) = 2.59$; $p = .017$, $d_z = 0.57$; TAU: for PTSD Total score, $t(15) = 1.46$, $p = .164$, Cohen's $d_z = 0.37$; for Intrusions, $t(15) = 1.93$, $p = .07$, $d_z = 0.48$; for Avoidance, $F(15) = 0.052$; $p = .96$, $d_z = 0.01$; for Arousal, $t(15) = 1.53$; $p = .148$, $d_z = 0.38$]. Figure 2 illustrates the changes in symptoms in the NET and TAU groups separately.

3.3.2. Clinically significant change

At T1, 80% (16/20) of participants in the TAU group and 85% (23/27) of participants in the NET group had clinical levels of PTSD. After the intervention, the proportion of participants exceeding the cut-off level had dropped to 45% (10/22) in the NET group, while in the TAU group 75% (12/16) of participants still exceeded the cut-off. McNemar tests showed that the difference between the share of participants with clinical-level PTSD at pretest versus post-test was significant in the NET ($p = .008$) but not in the TAU ($p = 1.00$) group.

Table 5. Levels of primary outcomes at pretreatment and post-treatment for treatment completers, with mean changes and effect sizes.

	Pretreatment				Post-treatment				Change					
	NET		TAU		NET		TAU		NET			TAU		
Outcome	*n*	*M* (*SD*)	*n*	*M* (*SD*)	*n*	*M* (*SD*)	*n*	*M* (*SD*)	*n*	*M* (*SD*)	g_{av}	*n*	*M* (*SD*)	g_{av}
Post-traumatic stress symptoms	22		16		22		16		21			16		
Hyperarousal		13.4 (7.6)		11.0 (6.5)		10.3 (7.1)		9.7 (5.9)		−3.52 (6.45)	0.46		−2.00 (5.24)	0.32
Intrusions		12.1 (4.4)		10.9 (5.2)		7.5 (5.3)		8.8 (6.5)		−4.81 (4.26)	0.97		−2.63 (5.44)	0.43
Avoidance		12.8 (5.0)		13.7 (5.8)		10.5 (6.1)		13.6 (5.7)		−2.00 (5.86)	0.35		+0.31 (5.04)	0.05
Total		38.3 (14.4)		35.6 (12.2)		28.2 (15.2)		32.1 (14.9)		−10.33 (12.70)	0.68		−4.31 (12.1)	0.30
Depressive symptoms	18	13.1 (9.2)	12	12.8 (5.0)	14	13.0 (8.6)	11	12.1 (6.4)	13	−2.08 (6.87)	0.22	11	−0.91 (3.73)	0.14
Resilience	18	14.6 (4.9)	13	13.3 (5.2)	15	15.1 (4.1)	11	15.0 (2.5)	14	+1.57 (3.61)	0.32	11	+2.00 (4.27)	0.43
Psychological distress														
Self-evaluated	18	14.6 (7.2)	10	15.4 (5.7)	12	14.7 (5.8)	9	13.4 (5.2)	12	−2.25 (4.69)	0.33	8	−2.50 (4.63)	0.39
Guardian-evaluated	13	18.0 (7.4)	10	17.3 (7.3)	10	15.0 (9.1)	11	15.8 (5.3)	10	−3.10 (5.80)	0.33	9	−3.33 (5.68)	0.50

NET, narrative exposure therapy; TAU, treatment as usual; g_{av}, effect size as Hedges' *g* using average variance.

Table 6. Repeated measures analysis of variance results for changes in post-traumatic stress disorder (PTSD) (*n* = 39) from pretest to post-test.

	PTSD Total score		Intrusions		Avoidance		Arousal	
	F	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Time	12.93	< .001	21.77	< .001	1.15	.291	8.15	.007
Group	0.00	.949	0.00	.996	1.15	.290	0.51	.478
Time*Group	1.98	.168	1.88	.179	1.30	.262	0.68	.416

df = (1,35). PTSD Total score, Intrusions, Avoidance, and Arousal subscales of the Children's Revised Impact of Event scale.

Table 7. Repeated measures analysis of variance results for changes in resilience (*n* = 26), psychological distress reported by the child (*n* = 21) and guardian (*n* = 21), and depression (*n* = 25) from pretest to post-test.

	Resilience		Psychological Distress, Self		Psychological Distress, Guardian		Depression	
	F	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Time	5.14	.033	4.970	.039	5.940	.026	1.66	.212
Group	0.07	.794	0.471	.501	1.15	.290	0.00	.949
Time*Group	0.07	.168	0.150	.908	0.011	.971	0.25	.620

df: Resilience (1,23), Psychological Distress Self-Evaluated (1,18), Psychological Distress, Guardian (1,17), Depression (1,22).

Five participants in the TAU group and six in the NET group did not exceed the clinical cut-off in T1. Two (TAU) and three (NET) of them experienced a decrease in PTSD symptoms, one in the TAU group remained at the same level, and one in the NET group experienced an increase in symptoms. Three of these children were among the dropouts.

3.3.3. Intention-to-treat analyses including follow-up

In linear mixed models for PTSD symptoms, adding random intercepts and slopes and accounting for autocorrelation significantly improved model fit. Final models confirmed that PTSD symptoms decreased over time (b = −0.32, 95% CI −0.48, −0.15, SE = 0.081, p < .001). However, adding a time × treatment interaction effect did not improve model fit and the interaction was not significant. For depressive symptoms, estimation of random slopes was not possible owing to limited data. Models with random intercepts confirmed no significant effect of time or time × treatment interaction.

For resilience, random slopes or autocorrelations did not improve model fit. In a model with random intercepts, there was a trend towards an increase in resilience over time (b = 0.04, 95% CI −0.0036, 0.089, SE = 0.023, p = .070). Adding a time × treatment interaction effect did not improve model fit and the interaction was not significant.

For both self-evaluated and guardian-evaluated psychological distress, random slopes or autocorrelations did not improve model fit. In models with random intercepts, psychological distress decreased over time both when self-evaluated (b = −0.091, 95% CI −0.16, −0.09, SE = 0.033, p = .0097) and when evaluated by the guardian (b = −0.11, 95% CI −0.20, −0.11, SE = 0.045, p = .021). Adding a time × treatment interaction effect did not improve model fit for either outcome and the interactions were not significant.

3.4. Safety of interventions

Child safety was closely monitored during the interventions by the routine procedures existing at each participating clinic. None of the clients was referred to inpatient clinics during or immediately after the study and there were no suicide attempts or other serious adverse events. We asked participants about negative and positive changes during the intervention. Two participants in the TAU group and three participants in the NET group reported negative changes related to family relations during the therapy. One participant in the NET group reported negative changes related to school during the intervention. These changes were discussed with the therapist after the intervention.

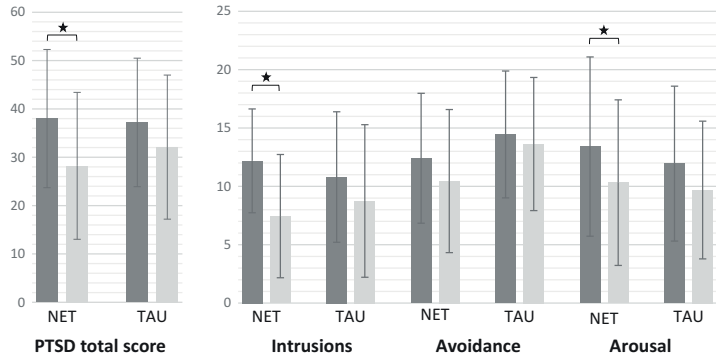

Figure 2. Levels of total post-traumatic stress disorder (PTSD) symptoms, and the Intrusions, Avoidance, and Arousal subscales at pretest (dark grey bars) and post-test (light grey bars). Mean group scores on the Children's Revised Impact of Event Scale are presented, with 95% confidence intervals. NET, narrative exposure therapy; TAU, treatment as usual. *Significant difference according to *t* tests at $p < .05$.

4. Discussion

Millions of children and adolescents around the world suffer from post-traumatic stress symptoms due to experiences of military and/or family violence, and providing them with the most effective forms of evidence-based help is a crucial, global concern. The participants in the current study were severely traumatized. Their PTSD symptom levels were very high (83% with clinical levels of PTSD) at the start of treatment, although most (84%) had already received prior psychiatric care for their mental health problems. Refugee children in particular face atrocities, insecurity, and deprivation of basic needs, premigration, in transit, as well as postmigration (Zimmerman, Kiss, & Hossain, 2011). Earlier research has shown that such experiences increase the risk for post-traumatic symptoms (Barber, 2013; Mels, Derluyn, Broekaert, & Rosseel, 2010). We still have limited evidence, especially from randomized controlled trials (RCTs), on the effectiveness of interventions targeted at children and adolescents exposed to multiple traumas. Concerning refugee children in high-income countries, such evidence is nearly nonexistent. At the same time, there is growing concern that results obtained from clinical research may not always apply to 'real-world' situations, because research is often carried out under artificial conditions with no active control groups (Ionnidis, 2005).

We found no evidence for superior effects of NET versus TAU on our primary outcome of reduction in levels of PTSD symptoms. However, looking at the changes observed in more detail, we found suggestions that NET was superior to TAU in some respects, although the limited follow-up measurements inhibit us from making strong conclusions. The results are promising for finding an effective tool to treat multiply traumatized children and adolescents, a patient group with whom many clinicians feel they lack suitable options. Although there was a decrease in PTSD symptoms regardless of treatment condition, within-group analyses showed that the decrease was significant in the NET group only. The effect sizes of decreases in Total PTSD and Intrusive symptoms were large with NET, but small in TAU. In addition, more participants in the NET group moved from 'clinical' to 'non-clinical' levels of symptoms at post-test. These results differ somewhat from those of Catani et al. (2009), who compared a meditation-relaxation protocol with KIDNET. That study found out that in both treatment conditions PTSD symptoms were significantly reduced, the effect sizes were large in both groups, and about the same number of children in both groups moved from 'clinical' to 'non-clinical' levels of symptoms at post-test. Since the TAU interventions in this study were resource demanding, such as family therapy and network meetings, the results are generalizable to other high-income countries but not to care environments where significantly fewer resources are available for the provision of healthcare.

A closer look at the changes showed that the difference from pretest to post-test was largest in intrusion symptoms in the NET group. Further research is needed to elucidate whether children and adolescents with flashbacks and nightmares are the ones who might especially benefit from NET or other exposure-based treatments. For the first time, this NET trial also included children and adolescents who were exposed to family violence exclusively. The finding that NET can be used and is safe among this group is important.

Psychological distress decreased and individual resilience increased in both groups, although these results must be interpreted with caution owing to the limited amount of data available for those measures. However, this can be seen as a cautious sign of

more general rehabilitation among children who receive treatment for their trauma. There was no change in depressive symptoms in either group. The search for possible reciprocal effects, however, was outside the scope of the current article and should be explored in further studies with better follow-up data, such as Mauritz et al. (2016). Reduction in PTSD symptoms has been shown to lead to reductions in depression in exposure-based therapy among adolescents (McLean, Su, Carpenter, & Foa, 2015).

As suggested by the learning health system approach by the Institute of Medicine (2015), the current trial was embedded within an existing system of healthcare, aiming at a cycle in which evidence is rapidly and continually fed back into clinical care, and clinical care itself informs the further development of the intervention. However, there were unexpected difficulties in recruiting participants. The biggest obstacle expressed by the trained therapists was the timing of trauma treatment. In many cases, they considered that the child would not be ready to be exposed to his or her trauma history and it was seen as better to continue stabilization as the treatment method. However, Ter Heide, Moore, van de Schoot, and De Jongh (2016) showed that there were no differences in safety or efficacy between exposure-based therapy and stabilization as usual for refugees. This means that trauma-focused treatments are often well tolerated and can be provided for patients with multiple traumas, albeit based on individual assessment. As descriptions of the TAU methods showed, therapists in participating units do not regularly use exposure-based methods with multiply traumatized children and adolescents in Finland. This is in line with Cahill, Foa, Hembree, Marshall, and Nacash (2006), who concluded that most patients with PTSD do not receive treatments consistent with expert consensus guidelines, as well as with Pottie et al. (2011) showing that there is a mismatch between refugee adolescents' needs and customs and the provided services. Thus, we assume that the problems in recruitment may reflect the more general hesitation concerning clinical interventions with severely and complexly traumatized children.

4.1. Limitations

The underpowered nature of the trial, high number of dropouts and missing data restrict the conclusions that can be drawn from this study. In addition, the analyses focusing mainly on the post-assessment point of time restrict the evidence for long-term effects. In two earlier NET trials among similarly aged children, recovery rates remained stable over a 6 month post-treatment period (Catani et al., 2009; Ruf et al., 2010), similar to our mixed-model-analyses including the 3 month follow-up. However, in a study by Schaal et al. (2009), the changes in symptom scores indicating long-term success of NET over an active control group were evidenced only 6 months after the treatments ended.

Another challenge for the trial was its reliance on mostly child-evaluated measures. Given the challenges faced by the parents of the participants, it was difficult to engage them in the study. However, parental report of psychological distress was included. In addition, as clinicians acted as assessors in this trial, the battery of measures and instruments had to be kept simple and manageable in scope.

The difficulties in finding eligible participants caused a challenge to the balanced block randomization (Schulz & Grimes, 2002). Irregularities in the randomization process were not identified, but cannot be completely ruled out as additional explanations for the imbalance in group sizes. However, the NET and TAU groups did not otherwise differ in the studied variables.

In the original study protocol (Kangaslampi, Garoff, & Peltonen, 2015), spontaneous recovery was planned to be controlled for by including a waiting-list control condition, utilizing the time spent in treatment queues. However, such queues did not exist at the treatment units participating in the study, and it was considered unethical to include a group with no treatment at all. This resulted in the lack of a passive control group.

Children who were included in the study based on referral and therapist's evaluation of traumatization but did not exceed the clinical cut-off in CRIES experienced mixed results, possibly suggesting that clinical-level PTSD symptoms are an important criterion when considering trauma treatment. Unfortunately, the SUDS was not used by all therapists to ensure that exposure really happened in those sessions where it was intended to happen.

Because the participating clinicians acted as both treatment providers and assessors, blinding them to the treatment status of each participant beyond randomization (after T0) was not possible. The participants themselves could not be blinded to the intervention, as the differences between TAU and NET made it obvious to them which group they belonged to. Finally, assessment of the safety of the intervention could have included systematic reporting of side effects.

4.2. Conclusions

In typical clinical use, it appears that NET is at least as effective as trauma treatments currently in use in the Finnish healthcare system. For some severely traumatized children and adolescents, NET and other exposure-based methods may even be a superior treatment method to methods that do not

include exposure. However, more research with larger samples and follow-ups are needed to confirm this finding. Close attention must be paid to the implementation of the new method. We should aim to improve clinicians' understanding of the safety and limited risks of exposure-based methods and diminish prejudices against such methods. Peer as well as supervisory support is needed when using the method with the first clients. Increasing confidence in the effectiveness of exposure-based methods, as evidenced by many RCTs, should inform the selection of treatment approaches for multiply traumatized children and adolescents.

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PUBLICATION IV

Changes in traumatic memories and posttraumatic cognitions associate with PTSD symptom improvement in treatment of multiply traumatized children and adolescents

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ORIGINAL ARTICLE

Changes in Traumatic Memories and Posttraumatic Cognitions Associate with PTSD Symptom Improvement in Treatment of Multiply Traumatized Children and Adolescents

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Abstract
Refinement, targeting, and better dissemination of trauma-focused therapies requires understanding their underlying mechanisms of change. Research on such mechanisms among multiply traumatized children and adolescents is scarce. We examined the role of improvements in problematic qualities of traumatic memories and maladaptive posttraumatic cognitions in PTSD symptom reduction, in a randomized, pragmatic trial of narrative exposure therapy vs. treatment as usual with 40 participants 9–17 years old (48% female, 75% refugee background) repeatedly exposed to war or family violence related trauma. Posttraumatic cognitions, quality of traumatic memories and PTSD symptoms were assessed by self-report before and after treatment. Improvements in both quality of traumatic memories ($r_{MI} = .36$) and posttraumatic cognitions ($r_{MI} = .46$) correlated with symptom reduction. However, improvement during treatment was only significant for quality of traumatic memories ($F_{MI}(11,333.56) = 4.77$), not for posttraumatic cognitions. We detected no difference in effects of narrative exposure therapy and treatment as usual on cognitions or memories. We tentatively suggest problematic, overly sensory and incoherent quality of traumatic memories may be a useful target in the treatment of PTSD symptoms among multiply traumatized children and adolescents. Changing maladaptive posttraumatic cognitions, though important, may be challenging among those with severe, repeated trauma.

Keywords PTSD · Intervention · Mechanism · Cognition · Memory · Children · War

Meta-analyses have found several trauma-focused treatments effective in treating posttraumatic stress symptoms (PTSS) among children and adolescents (Brown et al. 2017; Gillies et al. 2016). However, it is largely unclear to what extent they achieve their effects via the same or dissimilar processes. Identifying both shared and unique mechanisms of change that interventions tap into for their effectiveness is crucial for further development, effective dissemination and improved targeting of treatment approaches (Ehlers et al. 2010; Kazdin 2007; Zalta 2015). Simultaneously, regardless of type of treatment, assessing the relevance for recovery of particular mechanisms suggested as central by different theories of posttraumatic stress disorder (PTSD) provides for good tests of each theory's predictions. Here, we study mechanisms of change potentially involved in the treatment of PTSS among multiply traumatized children and adolescents.

This study is a preregistered, secondary analysis of data from a randomized, controlled trial comparing narrative exposure therapy (NET; Schauer et al. 2011) with treatment as usual (TAU), in a usual care, clinical setting (for details, see Peltonen and Kangaslampi 2019). Narrative exposure therapy is a manualized, short-term, trauma-focused cognitive-behavioral therapeutic intervention for adults and children who suffer from PTSS due to repeated traumatic events. NET differs from other exposure-based treatments by its emphasis on narrative reconstruction of the trauma survivor's autobiography by chronologically visiting and exposing the client to each traumatic memory in detail. As such, the NET protocol considers reintegration and contextualization of traumatic memories as central to treating PTSS (Schauer et al. 2011; Mørkved et al. 2014). NET was developed, and has mainly been studied, in the context of traumatic experiences related to war or armed conflict, with substantial evidence for effectiveness (reviewed in Robjant and Fazel 2010; Mørkved et al. 2014). Among adults, NET has also been successfully trialed with

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Saudi firemen with work-related trauma (Alghamdi et al. 2015), Chinese earthquake survivors (Zang et al. 2013) and women with comorbid borderline personality disorder and PTSD due to various trauma (Pabst et al. 2014). Four randomized controlled studies have previously demonstrated the effectiveness of NET with children or adolescents, all with conflict-related trauma (Catani et al. 2009; Ertl et al. 2011; Ruf et al. 2010; Schaal et al. 2009). The present study included both children and adolescents traumatized by experiences of war, armed conflict and refugeedom, as well as those who had experienced multiple traumatic events related to domestic physical or sexual abuse.

Despite increasing evidence for effectiveness in a variety of contexts, no studies have so far examined mechanisms of change involved in symptom improvement during NET treatment, neither on its own nor compared with other active treatment. Here we focus on two putative mechanisms: changes in maladaptive posttraumatic cognitions and improvement in the quality of traumatic memories.

Posttraumatic cognitions (PTCs) refer to dysfunctional or maladaptive appraisals of the traumatic event and its consequences. These overly negative, generalized or catastrophizing appraisals and beliefs typically relate to the self as fragile, incompetent or permanently changed for the worse due to the trauma or to the world as dangerous, scary, and unpredictable (Foa and Rothbaum 1998; Meiser-Stedman et al. 2009). Information processing accounts of PTSD suggest maladaptive PTCs have a key role in preventing recovery from PTSS by keeping up a sense of on-going threat and promoting the use of dysfunctional strategies to reduce distress (Ehlers and Clark 2000; Dalgleish 2004). Thus, they would be important targets for treatment, which developers of evidence-based PTSD treatments have also acknowledged (Schnyder et al. 2015).

The evidence base for the role of improvements in maladaptive PTCs in PTSS treatment by psychological methods is already quite robust among adults (Sripada et al. 2016; Zalta 2015). Change in maladaptive PTCs appears a rather general mechanism that many types of treatments might draw upon. Fine-grained longitudinal analyses suggest that it is indeed change in such appraisals and beliefs that leads to reduction in symptoms, and not vice versa (Kumpula et al. 2017; Kleim et al. 2013) – a crucial condition for claiming a mechanistic role (Johansson and Høglend 2007). Among children and adolescents, some previous research has identified change in maladaptive PTCs as a mechanism of change for decreased PTSS in cognitive (Meiser-Stedman et al. 2017; Smith et al. 2007) and exposure-based treatments (McLean et al. 2015). Yet, none of these studies has included children with trauma related to war or refugeedom.

Research suggests that exposure-based treatments like prolonged exposure have their effects partly via cognitive change (Cooper et al. 2017; Kumpula et al. 2017), so we might expect this to be the case for NET, as well. Despite the lack of overt cognitive restructuring, appraisals of the traumatic event and its meaning may change when aspects of the trauma are recollected or reconstructed that contradict or disconfirm maladaptive beliefs (Ehlers and Clark 2000; Foa and Rothbaum 1998; Schnyder et al. 2015) and the meaning of the traumatic event is reflected upon after exposure (Schauer et al. 2011). Alternatively, through integration of traumatic memories into a coherent life narrative, trauma-related thoughts and emotions might become better linked to their specific circumstances and context, correcting or attenuating over-general appraisals of ever-present threat (Schauer et al. 2011).

Several theoretical accounts of PTSD also suggest the problematic dual nature of traumatic memories to be intimately linked to PTSS (Brewin 2014; Ehlers and Clark 2000; Foa and Rothbaum 1998). On one hand, excessively sensory-based, non-declarative traumatic memories are easily recalled involuntarily based on environmental and internal cues, leading to distressing intrusive memories or flashbacks. While verbally and voluntarily accessible episodic memories of the trauma are suggested to be fragmented, disorganized, and/or poorly spatiotemporally contextualized in individuals suffering from PTSD. Despite somewhat differing terminology and emphasis, developers of evidence-based PTSD treatments have agreed on reorganization of memory as an important goal for trauma-focused treatment (Schnyder et al. 2015).

Previous research has examined trauma memory characteristics and their links to symptoms either by analyzing trauma narratives provided by survivors or by using self-report instruments of the qualities of traumatic memories. In the first tradition, evidence on whether memories of traumatic events are more fragmentary or less cohesive among those with significant PTSS is mixed (Brewin 2014; O'Kearney et al. 2007; Rubin et al. 2016; Salmond et al. 2011). Further, fragmentation in trauma narratives does not necessarily decrease with successful treatment, casting further doubt on the specific relevance of narrative fragmentation for PTSS (Bedard-Gilligan et al. 2017; Desrochers et al. 2016). The present study focused on the self-reported quality of traumatic memories, which has also been characterized as perception of memory quality (McKinnon et al. 2017). Previous studies using self-report measures likewise provide mixed results. Following adult survivors of recent assault over six months, Halligan et al. (2003) found those with current PTSD to report more disorganized traumatic memories. The self-reported disorganized quality of the traumatic memory was associated with PTSS up to six months later. However, change in self-reported disorganization was not related to changes in PTSS severity in this study. Among children, Salmond et al. (2011) did not find self-reported problematic qualities of traumatic memory to predict acute stress symptoms beyond the effect of narrative disorganization. McKinnon et al. (2017) reported that self-reported memory quality was a stronger cross-sectional and

prospective predictor of PTSS than features of the trauma narrative. In that study, change in self-reported trauma memory quality was also linked to change in PTSS over three months after the trauma. All these studies examined naturalistic change after single-incident trauma. To our knowledge, no similar studies exist among multiply traumatized children or adolescents, representing a significant gap in knowledge.

McKinnon et al. (2017) called for their results to be replicated in the context of change due to therapy. So far, just one study has specifically looked at improvements in the quality of traumatic memories, whether as narratives or self-reports, as a mechanism of change in treatment of PTSS. In a study on cognitive therapy among children and adolescents suffering from PTSD, again due to recent single-incident trauma, Meiser-Stedman et al. (2017) found that improvements in the self-reported quality of traumatic memories over the course of the treatment were linked to the treatment's effects on PTSS. However, when changes in memories from pre-intervention to just midway through it were examined instead, they were not found to significantly mediate pre-post improvements in symptoms. Thus, the authors were unable to demonstrate the temporal sequence of changes in traumatic memories and PTSS.

In light of this disparity between major theoretical emphasis, mixed indirect evidence and almost total lack of direct evidence for a mediating role, research on changes in the quality of traumatic memories during PTSD treatment is sorely needed. As integration and contextualization of traumatic memories is a central aim and focus in its protocol, NET might be especially suited for exploring this putative mechanism. At the same time, examining whether improvements in the quality of traumatic memories can also occur during mainly non-trauma-focused TAU provides an important point of comparison.

The present study has two main objectives. First, we examine changes in maladaptive posttraumatic cognitions and in self-reported problematic qualities of traumatic memories during treatment of posttraumatic stress symptoms among multiply traumatized children and adolescents in a usual care environment, and possible differences between narrative exposure therapy (NET) and treatment as usual (TAU) in these changes. We also explore whether such changes in cognitions and memories are related to reduction in posttraumatic stress symptoms. We hypothesize that, while both maladaptive posttraumatic cognitions and problematic qualities of trauma memory representations are likely to decrease during treatment for both groups, these decreases are greater in NET than during TAU. Second, we aim to test whether changes in posttraumatic cognitions and the quality of traumatic memories act as mechanisms of change responsible for NET's effectiveness in reducing posttraumatic stress symptoms, compared with TAU.

Method

Participants

The participants of this study were children and adolescents 9–17 years of age receiving treatment at cooperating units for stress symptoms evaluated to result from exposure to repeated trauma. Exclusion criteria included acute psychosis, active suicidal ideation, active serious substance abuse, and intellectual disability.

Due to the pragmatic nature of the trial, with interventions and assessments taking place at a variety of different usual care environments, there were some dropouts (eight out of 50 before end of treatment) and a substantial share of data was missing. This analysis concerns those children and adolescents who completed NET or TAU and for whom at least some measurements after treatment were available, a final sample of 40 participants. Reasons for dropout are reported elsewhere (Peltonen and Kangaslampi 2019).

The participants of this study were 9–17 years old (M = 13.30; SD = 3.06), with 19 girls and 21 boys. Ten participants were born in Finland and had experiences of family violence, while 30 participants were born outside Finland, most commonly in Iraq (n = 11) or Afghanistan (n = 11), and had experiences of war or refugeedom. Of this sample, 23 received NET, while 17 completed TAU.

Procedure

This analysis is based on data from a randomized, controlled, open-label, multisite, pragmatic trial of NET vs. TAU in usual care environments. The trial was registered on ClinicalTrials.gov (NCT02425280) before any work on it commenced. The study protocol of the trial was also published beforehand (Kangaslampi et al. 2015). Plans for analysis of mechanisms of change were included in this pre-registered protocol. Some changes to the protocol were necessary over the course of the study. In particular, 1) planned assessments of changes in cognitive performance could not be carried out; 2) the target group of the trial was extended to include children and adolescents with experiences of violence in the family; and 3) the collection of waitlist control data was largely unsuccessful.

Clinicians (psychologists, medical doctors, social workers, nurses) with previous experience working with traumatized patients at inpatient and outpatient units, primary healthcare and asylum seeker housing units in Finland were first trained in NET. The clinicians then recruited suitable participants for the study at their corresponding units and provided NET or TAU to the participants. The therapists also acted as assessors, collecting data from the patients they were treating largely the same way they would normally track their patients' symptoms and effects of treatment. In line with principles of pragmatic

trials, the researchers were involved in the treatment practice as little as possible.

Participants were randomized into NET or TAU using sealed, opaque envelopes with a 1:1 distribution for each unit. No attempt was made to blind participants to the type of intervention they received. As measurements were based on self-reports, assessment was not blinded either. Written consent to participate in the study was requested from the participants themselves and their parents or guardians. The ethical boards of Pirkanmaa Hospital District, Tampere City Welfare Services, the Helsinki Diaconess Institute, and the Hospital District of Southwest Finland approved the study.

For participants randomized into the NET group, narrative exposure therapy was implemented as described in the 2nd edition manual (Schauer et al. 2011), with 7–10 treatment sessions of around 90 min, for a total duration of approximately three months. The TAU comparison group received whatever treatment and attention they would normally receive at the cooperating unit for a similar duration. According to information provided by the clinicians, this ranged from case management and supportive discussions to family therapy and network meetings, and non-trauma-focused psychotherapy. Changes in pharmacotherapy were not mentioned. More details on implementation, as well as the results of this trial on the effectiveness of NET vs. TAU on primary outcomes are reported elsewhere (Peltonen and Kangaslampi 2019).

Measures

All measures were available in Finnish, English, Arabic, Dari, and Sorani (Central Kurdish) translations. For those few children or adolescents who did not speak any of these languages, an interpreter read out the questions and response alternatives to them. Assessments were carried out by the treating clinicians at the start of the intervention (T1) and at the end of the intervention (T3). For some participants, assessments were also made mid-way through the intervention (T2) and at follow-up approximately three months after the intervention (T4).

Posttraumatic Stress Symptoms The Children's Revised Impact of Events Scale (CRIES; Smith et al. 2003) is a self-report questionnaire based on DSM-IV criteria for PTSD. The children and adolescents evaluated on a 4-point scale how often they had experienced a particular symptom over the last two weeks (0 = *not at all*, 1 = *rarely*, 3 = *sometimes*, 5 = *often*). We used a total sum with a theoretical range of 0–65. In this sample, internal consistency was good at T1 (Cronbach's $\alpha = .83$, 95% CI [.75, .90]), T2 ($\alpha = .80$, 95% CI [.71, .89]), T3 ($\alpha = .87$, 95% CI [.81, .93]), and T4 ($\alpha = .90$, 95% CI [.86, .95]).

Posttraumatic Cognitions The Child Post-Traumatic Cognitions Inventory (CPTCI; Meiser-Stedman et al. 2009) is a self-report questionnaire of 25 items assessing maladaptive posttraumatic thoughts and appraisals among children and adolescents. The children and adolescents evaluated on a 4-point scale (1 = *don't agree at all*, 2 = *don't agree a bit*, 3 = *agree a bit*, 4 = *agree a lot*) to what extent they agreed with each statement provided. We used a total sum variable, with a theoretical range of 25–100. Internal consistency was excellent at T1 ($\alpha = .91$, 95% CI [.88, .95]), T2 ($\alpha = .94$, 95% CI [.91, .97]), T3 ($\alpha = .96$, 95% CI [.95, .98]), and T4 ($\alpha = .97$ 95% CI [.95, .98]).

Quality of Traumatic Memory The Trauma Memory Quality Questionnaire (TMQQ; Meiser-Stedman et al. 2007) is an 11-item self-report questionnaire on the problematic qualities of traumatic memories. An example item is "My memories of the frightening event are mostly pictures or images". The children and adolescents evaluated on a 4-point scale (1 = *don't agree at all*, 2 = *don't agree a bit*, 3 = *agree a bit*, 4 = *completely agree*) how well the statements fit their traumatic memories. We used a total sum variable with a theoretical range of 11–44. Internal consistency was good to excellent at T1 ($\alpha = .88$, 95% CI [.82, .93]), T2 ($\alpha = .90$, 95% CI [.86, .95]), T3 ($\alpha = .90$, 95% CI [.85, .94]), and T4 ($\alpha = .90$, 95% CI [.86, .95]).

Data Analysis

A large share of data was missing, a total of 28.3% at T1, 57.0% at T2, and 25.0% at T3. Due to the majority of data missing for mid-intervention measurements, we only examined pre-post changes in most of our analyses, and used T2 measurements as additional data points for repeated measures analyses of variance only. Follow-up measurements were missing for a large share of participants in a non-random manner, and we could thus not use them in our analyses.

To account for missing data, we used multiple imputation by chained equations, employing the *mice 2.9* R package (van Buuren and Groothuis-Oudshoorn 2011) to generate 50 imputed data sets to replace missing data at the item level. According to simulation studies, item-level imputation provides greater statistical power than imputing at scale level, which has been common in the past (Gottschall et al. 2012). For inclusion as a predictor for each variable with missing values, we set a .30 minimum correlation threshold. As additional predictor variables for imputation, we used available demographic variables, additional data collected on depressive symptoms (Depression Self-Rating Scale for Children; Birleson et al. 1987) and on strengths and difficulties (Strengths and Difficulties Questionnaire; Goodman 1997), as well as CRIES, CPTCI and TMQQ scores at follow-up, where available. All the following analyses are based on

pooled estimates from the multiply imputed data sets and marked with an "MI" subscript.

We used repeated-measures analyses of variance to assess changes in posttraumatic cognitions and traumatic memories over the course of treatment, and differences between the treatment conditions in such changes. We further assessed the relationship between pre-post changes in posttraumatic cognitions and changes in traumatic memories with pre-post improvements in PTSS by correlation analyses.

For mediation analyses, we used maximum-likelihood path analysis implemented with the *lavaan 0.6–3* R package (Rosseel 2012), together with the *semTools 0.5–1* package (Jorgensen et al. 2018) to allow for analyses in multiply imputed datasets. We specified separate path models for CPTCI and TMQQ scores as mechanisms. In each model, CRIES scores at T3 were regressed on T1 CRIES scores, a dummy variable for type of intervention and, and CPTCI/TMQQ scores at T3 (the *b* path for mediation analysis). The CPTCI/TMQQ score at T3 was in turn regressed on CPTCI/TMQQ scores at T1, CRIES scores at T1, and the intervention dummy variable (the *a* path for mediation analysis). Because of the complexity of combining multiple imputation with bootstrapping approaches, we used the conservative asymptotic normal distribution method of constructing confidence intervals around the estimates of indirect effects, *a * b,* to assess the significance of mediated effects. We carried out all data processing and analyses using R 3.4.3 (R Core Team 2017). Input scripts are available upon request from the first author.

Results

Descriptive Statistics

Table 1 presents the levels of posttraumatic stress symptoms, maladaptive posttraumatic cognitions and problematic qualities of traumatic memories before and after treatment for the two intervention groups separately and in aggregate, based on multiply imputed data.

Changes in Posttraumatic Cognitions and Traumatic Memories during NET and TAU

Repeated-measures ANOVA indicated a significant effect of Time on traumatic memories ($F_{MI}(11,333.56) = 4.77$, $p = .029$), but no significant effect of Intervention ($F_{MI}(135,050.44) = 0.62$, $p = .431$) or Time × Intervention interaction ($F_{MI}(14,315.37) = 0.84$, $p = .361$). For posttraumatic cognitions, results indicated no significant effect of Time ($F_{MI}(13,726.70) = 1.45$, $p = 0.229$), Intervention ($F_{MI}(157,323.45) = 0.75$, $p = .386$) or Time × Intervention interaction ($F_{MI}(1, 4498.45) = 0.95$, $p = 0.330$). There was also a significant effect of Time ($F_{MI}(131,663.39) = 9.78$, $p = .002$) on posttraumatic stress symptoms, but no effect of Intervention ($F_{MI}(1,372,675.75) = 0.027$, $p = .870$), or Time × Intervention ($F_{MI}(1, 15,347.50) = 1.69$, $p = .194$).

Changes in PTSS from pretest to posttest correlated significantly with changes in posttraumatic cognitions from pretest to posttest ($r_{MI} = .46$, 95% CI [.11, .70], $p = .011$). Changes in PTSS from pretest to posttest likewise correlated significantly with changes in traumatic memories from pretest to posttest ($r_{MI} = .36$, 95% CI [.01, .63], $p = .044$).

Mediation Analyses

Mediation analyses indicated that CPTCI scores at T3 predicted CRIES scores at T3, accounting for pretest CRIES scores ($b_{MI} = 0.54$, $SE = 0.11$, $p < .001$). However, participation in NET vs. TAU did not significantly predict CPTCI scores at T3, accounting for pretest levels ($b_{MI} = -3.22$, SE = 3.51, $p = 0.359$.), and there was no evidence of mediated effects on CRIES scores at T3 via CPTCI scores at T3 (indirect effect = −1.74, 95% CI [−5.61, 2.13]).

Similarly, for changes in traumatic memories, TMQQ scores at T3 predicted CRIES scores at T3, accounting for pretest CRIES scores ($b_{MI} = 0.84$, $SE = 0.24$, $p = .001$).

Table 1 Levels of maladaptive posttraumatic cognitions, problematic qualities of traumatic memories, and posttraumatic stress symptoms at pretest and posttest for multiply traumatized children and adolescents receiving two types of treatment for posttraumatic stress symptoms

	Narrative exposure therapy ($n = 23$)					Treatment as usual ($n = 17$)					Whole sample ($n = 40$)				
	Pretest		Posttest			Pretest		Posttest			Pretest		Posttest		
Measure	*M*	*SD*	*M*	*SD*	d_{rm}	*M*	*SD*	*M*	*SD*	d_{rm}	*M*	*SD*	*M*	*SD*	d_{rm}
CRIES	37.84	14.41	28.38	14.85	0.65***	35.63	12.31	31.72	14.68	0.29	36.90	13.44	29.80	14.69	0.50***
CPTCI	55.89	13.91	52.01	18.12	0.22	51.40	11.62	50.79	14.61	0.04	53.99	13.02	51.49	16.52	0.16
TMQQ	28.03	7.81	25.99	7.64	0.26*	27.57	7.37	24.03	8.83	0.43	27.83	7.54	25.16	8.12	0.34*

CRIES Children's Revised Impact of Event Sale, *CPTCI* Child Post-Traumatic Cognitions Inventory, *TMQQ* Traumatic Memory Quality Questionnaire. Pooled estimates based on 50 multiple imputation sets. * $p < .05$. *** $p < .001$

However, participation in NET vs. TAU did not predict TMQQ scores at T3, accounting for pretest levels (b_{MI} = 1.52, SE = 2.13, p = .477), and there was again no evidence of mediated effects on CRIES at T3 via traumatic memories at T3 (indirect effect = 1.27, 95% CI [−2.44, 4.97]).

Discussion

Understanding how successful treatment of posttraumatic stress symptoms (PTSS) takes place is crucial for further development, better targeting, and effective dissemination of treatment approaches. Existing evidence on mechanisms of change involved in PTSS treatment among multiply traumatized children and adolescents is very limited. Here, we examined changes in maladaptive posttraumatic cognitions (PTCs) and problematic qualities of traumatic memories as potential mechanisms of change during narrative exposure therapy and treatment as usual. Previously, a number of studies have found a link between improvements in PTCs and successful treatment of PTSS among children and adolescents (Jensen et al. 2018; McLean et al. 2015; Meiser-Stedman et al. 2017; Smith et al. 2007), though studies among children or adolescents traumatized by war and in usual care environments are lacking. In contrast, despite theoretical emphasis on their importance, the role of changes in the quality of traumatic memories in treatment of PTSS has only been tentatively shown in a single study for children and adolescents with single-incident trauma (Meiser-Stedman et al. 2017).

Our results here showed that positive changes over the course of treatment in both PTCs and the quality of traumatic memories were associated with recovery from PTSS among multiply traumatized children and adolescents. Those children who experienced improvements in cognitions, such as viewing the world as less threatening and themselves as less vulnerable, and in traumatic memories, such as describing their memories as less sensory-based and incoherent and more verbally available, saw more reduction in symptoms. However, we only found evidence of overall average improvement over the course of treatment in the quality of traumatic memories, not in PTCs.

We did not find evidence that NET would affect PTCs or the quality of traumatic memories to a greater degree than treatment as usual, as currently provided by various units in the Finnish healthcare system. This was unexpected, as based on its principles of action (Schauer et al. 2011) and earlier findings with other exposure-based therapies (McLean et al. 2015), we hypothesized that NET would be more able to effect change in cognitions and especially memories than TAU, which did not, in most cases, directly address the traumatic events. While finding TAU to have near equivalent therapeutic effects to evidence-based treatments is rather common (Kazdin 2015), it remains unclear how the largely non-trauma-focused TAU in this case also resulted in improvements in the quality of traumatic memories. As the same therapists carried out NET and TAU, some spillover effects from the provided NET training are possible. Even during TAU, therapists might have, e.g., encouraged participants to verbalize and contextualize their traumatic memories, or set in motion emotional processing of the memories outside treatment sessions.

The changes we observed in both putative mechanisms were modest overall. Employing the same measures as here, Meiser-Stedman et al. (2017) reported much greater changes in PTCs and traumatic memories from pre- to posttreatment with Cognitive Therapy for PTSD in children and adolescents after single-incident trauma. Especially the fact that NET and TAU did not appear to significantly change the maladaptive trauma-affected thinking patterns of these multiply traumatized children and adolescents needs explanation. It is possible that maladaptive, overly negative PTCs resulting from long-term, repeated exposure to interpersonal trauma, especially war and conflict, are less susceptible to change than those resulting from single, anomalous incidents. In continuously dangerous environments, appraisals of the world as dangerous and unpredictable may have been adaptive and realistic for these children and adolescents, which could explain why it is difficult to alter them in short-term treatment. Although there was no longer any acute threat to life among the participating children, the effects of uncertainty and experienced losses related to close family members remained and might contribute to the persistence of maladaptive cognitive appraisals.

One study on a psychosocial group intervention among war-affected children similarly found no significant changes in PTCs (Kangaslampi et al. 2016). Outside of conditions of war, however, other studies of trauma-focused treatment that have included adolescents exposed to repeated interpersonal trauma have observed significant changes in PTCs that have contributed to symptom reduction (e.g., Jensen et al. 2018; McLean et al. 2015). Due to the limited sample size, we could not study the possible moderating effect of experiences of war versus family violence on effectiveness of treatment or change in the suggested mechanisms. Such comparisons on the importance of type of trauma experienced for treatment effects and mechanisms of change involved are sorely needed to understand whether improvements in PTSS can be achieved through similar mechanisms for children and adolescents exposed to war, as well.

Strengths and Limitations

The real-life, multisite usual care setting of the study, despite causing significant challenges, increases our confidence in the generalizability of our results to similar healthcare systems.

We consider studying multiply traumatized children and adolescents, including those with war-related trauma, another strength of the study, as previous studies on mechanisms of change among children have often concentrated on single-incident trauma. Importantly, our planned analyses of mechanisms of change and hypotheses were preregistered before any collection of data.

However, we should also point out a number of major limitations. First, this analysis relies on self-report measures. Other types of measures for maladaptive PTCs have been called for (e.g., Schnyder et al. 2015), but not, to our knowledge, presented. For traumatic memories, alternatives include behavioral measures of the frequency of intrusions. However, such measures do not capture the qualitatively problematic nature of traumatic memories as excessively sensory, fragmented, or inadequately contextualized and integrated, but rather represent occurrence of intrusive symptoms, considered here as part of PTSS. Outsider-rated indices of fragmentation or coherence based on written or oral trauma narratives have also been used. Self-reports of the quality of traumatic memory might be less prone to the effects of distress or avoidance than providing a detailed narrative (Halligan et al. 2003). On the other hand, self-reports may be criticized for being influenced by demand characteristics (Pasupathi 2007) and for the problems inherent in trauma survivors thought to suffer from memory problems or deficits providing self-reports on their memories (O'Kearney and Perrott 2006). Self-reports of memory quality may perhaps be more adequately described as measures of meta-memory or perception of memory quality (McKinnon et al. 2017).

Further, the instruments we used to assess PTCs and traumatic memories both refer to "the event". However, our participants had experienced multiple traumatic events and NET treatment involves exposure to all or most of them, instead of a single event. Participants were instructed to think of the worst or prototypical traumatic event. Still, this may mean the instruments did not fully capture changes in memories related to other events or cognitions reflecting the participants' general trauma-affected view of the world. Development of research instruments more appropriate for the assessment of multiply traumatized children and adolescents is a crucial future task. In the first place, such instruments should refrain from concentrating on just a single causative event. Beyond this, they should attempt to capture more fully the wide-ranging effects repeated interpersonal trauma may have on children's appraisals and world view, especially during sensitive periods of development.

Second, despite a moderately sized sample, due to the real-life usual care setting where the data were collected, a large portion of data was missing. This meant we could only employ pretest and posttest assessments in most analyses, and statistical power was inadequate to detect smaller effects, despite the use of sophisticated methods to deal with missing data. Overall, our results here and in the primary analyses of the trial reported elsewhere (Peltonen and Kangaslampi 2019) suggest that our sample may not have been adequately powered to detect differences between NET and TAU. Further, despite our attempts to collect follow-up data three months after treatment ended, so much follow-up data was missing in a non-random pattern that it could not be included here, except as auxiliary data to support multiple imputation. We should also note that while changes to possible pharmacotherapy were not made in the NET group nor noted in the TAU group during treatment, we cannot completely rule out possible chance differences in medication use between the groups, as we did not have access to full medical records.

Third, in the original protocol for this study (Kangaslampi et al. 2015), we planned to employ the waiting period before start of treatment as a waiting list control condition. However, waiting times were shorter than expected, and we received little data on such a waiting period. Thus, we could not compare changes during NET and TAU to a waitlist condition. Such comparisons would have been valuable to elucidate whether changes in PTCs and traumatic memories acted as mechanisms of change in PTSS reduction in treatment overall as compared with no treatment. Including both active and passive control conditions in future studies is highly advisable.

Conclusions

Demonstrating an effect on the specific mechanism(s) proposed to account for a treatment's effectiveness would increase our confidence in that treatment. At the same time, uncovering shared, general mechanisms that differing treatment approaches, when successful, draw upon, is crucial for refinement and better targeting of these treatments (Ehlers et al. 2010).

Acknowledging the substantial limitations of the current study, we may suggest that while the multiply traumatized children and adolescents in our study maintained much of their assessments of the world as a scary, unpredictable place and of themselves as vulnerable, they were able to moderate some of the frightening, "unspeakable" aspects of their memories (sights, sounds, and sensations) related to highly adverse events, which was linked to alleviation of PTSS. Problematic qualities of traumatic memories may form an important target of treatment, at least among those children and adolescents with multiple experiences of interpersonal trauma. However, we were unable to demonstrate that such changes would be a mechanism of change specific to NET. Additional research with larger samples is required to elucidate, first, whether improvements in the quality of traumatic memories are a major mechanism of change in the treatment of PTSS overall, and second, whether NET or similar exposure-based methods may

have more of their effects via this mechanism than other forms of treatment.

In line with previous research, we found that improvements in maladaptive posttraumatic cognitions were associated with recovery from posttraumatic stress symptoms. We did not, however, observe significant changes in such cognitions over the course of treatment. This may suggest effecting change in posttraumatic cognitions is more challenging for multiply traumatized children and adolescents overall or for those affected by war and conflict in particular. Children and adolescents traumatized by war have been seriously underrepresented in studies of trauma-focused treatment overall, and in studies of the mechanisms of such treatment in particular. Studying whether the psychological mechanisms that lead to symptom improvement among this population may differ from those exposed to single-incident trauma or repeated trauma not related to war is an important future task. In any case, preregistered analyses of mechanisms of change should be included in all future trials of treatments for PTSS.

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Compliance with Ethical Standards

Disclosure of Interest The authors declare that they have no conflicts to report.

Ethical Standards and Informed Consent All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all patients and their guardians for being included in the study.

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